USER MANUAL

of hot water pellet boiler

of series “Pelletherm v2 M01”

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Thank You for buying hot water pellet boiler of series „Pelletherm v2”. This manual will help You to use and maintain the unit properly.

The boiler’s producer company requires the installer technicians, which will perform the installation, maintenance and service procedures of the boilers of series “Pelletherm v2” to be trained and certified by the producer.

NOTE: in the following document is used the designation “Pelletherm v2”, which includes all the models of the hot water pellet boilers: “Pelletherm 30v2” and “Pelletherm 45 v2”, applicable for any boiler’s modifications**.**

ATTENTION!

IN INTEREST OF YOUR PERSONAL SECURITY IT IS OBLIGATORY TO READ THOROUGHLY AND CAREFULLY THIS INSTRUCTION MANUAL BEFORE PROCEEDING WITH ANY ACTIONS WITH THE BOILER – MOUNTING, CONNECTING, ETC. IN CASE THE REQUIREMENTS, DEPICTED IN THIS MANUAL ARE NOT SATISFIED, FAILURES OF THE UNIT COULD BE EXPECTED, OR EVEN FATAL CONSEQUENCES, FOR WHICH THE PRODUCER COMPANY DOES NOT TAKE RESPONSIBILITY.

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1. Hot water pellet boiler of series “Pelletherm v2” – description, properties and advantages.

“Pelletherm v2” is steel-plate hot water pellet boiler, which uses solid biomass fuel in shape of pellets. The boiler is designed to be connected to local hot-water heating systems, as well as heating up domestic hot water. The boiler uses wood pellets, as well as other type/shape of biomass, the resulting heat energy from thermo-chemical conversion (i.e. combustion process) is transmitted to the circulation water in its water jacket and the heat energy is transported to the heating system/consumer.

The hot water pellet boiler of series “Pelletherm v2” includes:

- *hot water boiler – 1 sp.;*
- *ash tray – 1 sp.;*
- *foot-screws for installation and leveling – 8 sp.;*
- *pair of working gloves – 1sp.;*
- *working apron – 1 sp.;*
- *instruction manual – 1 sp.;*
- *annex of the instruction manual – 1 sp;*

The unit could utilize following types of fuel:

- Wood pellets, having diameter 6 up to 14 mm, categorized in the range of: A, AB, B, BC, C, CD, E, EF (according to the methodology, developed for pellets properties estimation in boiler’s producer company);
- Pre-dried nuts (cherries for example);
- Fuel mixture – pellets and nuts (for example mixture ratio could be 50% - 50%);
- Pellets, produced of any other solid biomass (for example olive husk residue);
- Other solid biomass based pellets, but confirmation for these fuels utilization need testing and approval by boiler’s producer company laboratory;

The unit is equipped with:

- Steel plates welded heat exchanger for heating-up the circuit water;
- Flue gas fan;
- Fresh air supplying fan;
- Burner's ash removal mechanism – removes the ash residuum out of the burner's grate;
- Daily fuel hopper with capacity of about 100 kg;
- Operating module, which controls the functions of the unit and is adjustable to the specific need of a heating system as well as the properties of the fuel;
- Ash residue container with capacity of approximately 5 kg;
- Manually driven semi-automatic ash cleaning system (this system cleans the ash, deposited on the internal surface of the pipes of boiler's convective section);

The unit is supplied with :

- Automatic fuel ignition system;
- Automatic burner's ash removal system;
- Semi-automatic ash (deposited on the surfaces of the heat exchanger pipes) cleaning system;
- Automatic fuel feeding auger system;

Unit's advantages:

- The hot water boiler is designed to utilize solid biomass fuel, making it environmentally friendly, CO_2 neutral and does not contribute to the global warming process – result of fossil fuel utilization;
- The specific price of the heat energy, delivered by solid biomass utilization is less dependent on the world fuel market trends and practically the heat energy price is competitive to the conventional energy sources;

- The boiler is automatic and the thermal comfort achieved is close to that, originating from exploitation of fully automatic boilers, (for example liquid or gas fuel, as well as electric boiler), which makes is applicable in heating systems, equipped with programmable room thermostat;
- The unit is equipped with automatic fuel ignition system and another one for burner's grate ash cleaning;
- The design of the heat exchanger is optimized and realizes three way flue gas duct, thus allowing intensive heat exchange rate and high efficiency of the boiler (above 90%) and reduced fly ash particles emission to the chimney;
- Automatic unit operation. Hot water boiler could be connected to programmable room thermostat (weekly programmable), which guarantees maximal thermal comfort and economical fuel consumption;
- The unit utilizes solid biomass fuel, in shape of pellets (wood pellets), dried nuts (cherry nuts for example), which have ash contents higher that the limits, defined in following norms: ENplus (EN 14961-2:2010), ONORM M7135, DIN 51731 и DINPlus;
- High efficiency;
- Low pollutant contents in the flue gases;
- The unit is applicable for domestic hot water heating purposes;
- Automatic fuel feeding system, transported from the built-in "daily" hopper to the burner;
- The control operating module can operate the function of additional external fuel feeding system, which deliver fuel to the built-in fuel hopper from external one;
- Simplified maintenance and service procedures;
- Minimized running costs;

2. Hot water boiler of series "Pelletherm v2" technical data.

- Thermal and technical data for hot water pellet boiler of series "Pelletherm v2", utilizing wood pellets are given in **Table 2.1**;
- Dimensions and technical data for hot water pellet boiler of series "Pelletherm v2" are given in **Table 2.2;**
- Recommended solid fuel properties – wood pellets, are given in **Table 2.3;**
- Pellets classification, considering their physical properties (based on fuel proximate analysis) are shown in **Table 2.4;**
- ENplus – the European standard for wood pellets is shown in **Table 2.5**;

Parameter	Dimension	Value	
Model of the hot water boiler		Pelletherm 30v2 M01	Pelletherm 45v2 M01
Nominal thermal capacity	*kW*	*30*	*45*
Thermal capacity operation range	*kW*	*9 – 30*	*13 - 45*
Utilized solid fuel	• *Wood pellets;* • *Pre-dried cherry nuts;* • *Other dried nuts;;*		
Utilized wood pellets, complying ENplus	*ENplus-A1, ENplus-A2, ENplus-B*		
Utilized pellets, complying with boiler's producer classification methodology	*A, AB, B, BC, C, CD, D, DE*		
Wood pellets fuel consumption rate at nominal thermal capacity	*kg/h*	*6.9*	*10.4*
Fresh air flow rate, required for effective combustion process and boiler operation	*kg/h*	*50 - 60*	*75 - 90*
	m^3/h	*42 - 50*	*63 - 75*
Mass flow rate of the exhaust gases	*g/s*	*18.6*	*27.9*
Averaged wood pellets consumption rate (the unit is operating in a popular heating system)	*kg/h*	*4.5*	*6.75*
Thermal efficiency at nominal capacity	*%*	*93.4*	*93.2*
Air excess ratio	*λ*	*1.4 – 1.6*	
Flue gases temperature at nominal thermal capacity	*°C*	*110 – 120*	*140 - 150*
Solid fuel residue	*ash*	*The quantity depends on the ash contents in the raw fuel, as well as operating conditions*	

Table 2.1 Thermal and technical data for hot water pellet boiler of series "Pelletherm v2", utilizing wood pellets**.**

Parameter		Dimension	Value	
Model of the hot water boiler			Pelletherm 30v2 M01	Pelletherm 45v2 M01
Weight		*kg*	*460*	*575*
Water jacket capacity		*dm³*	*95*	*120*
Fuel hopper capacity		*dm³*	*152*	
		kg	*100 kg wood pellets*	
Overall dimension of the unit (WxDxH)		*mm*	*1515 x 850 x 1375*	*1618 x 850 x 1380*
Class (according to EN 303-5)		-	*3*	
Operating overpressure of the circulating water		*MPa*	*0.25*	
Heating system expansion vessel type		-	*Opened or closed (up to 0.25MPa)*	
Factory tested overpressure		*MPa*	*0.4*	
Recommended circulating water temperature		*°C*	*80*	
Minimal recommended return water temperature		*°C*	*60*	
Draught		*hPa*	*0.1 - 0.2*	
Connections	*Supply/return flow*	*G*	*1½"*	
	Drainage	*G*	*½"*	
	Flue gases duct	*mm*	*150*	
Hydraulic losses of the circulating water at nominal thermal capacity		*hPa*	*2.95*	*5.94*
Power supply		-	*L1, N, PE, 50Hz; 230V*	
Electrical capacity		*VA*	*120 + 250 (at ignition process)*	
Electric protection		-	*IP20*	

Table 2.2 Dimensions and technical data for hot water pellet boiler of series "Pelletherm v2".

Parameter	Dimension	Value
Pellet's characteristic size	*mm*	*6 – 14*
Recommended fuel net calorific value (low heating value)	*MJ/kg*	*>17.2*
	kWh/kg	*>4.7*
Wood pellet class	**---**	**ENplus-A1, ENplus-A2, ENplus-B**
Wood pellets category	A, AB, B, BC, C, CD, E, EF	
Ash content	*%*	*See Table 2.4. and Table 2.5*
Moisture content	*%*	*Max. 8 – 10%*

Table 2.3 Recommended solid fuel properties – wood pellets**.**

Pellet's category	A^d	DU
A	$A^d \leq 0.6\%$	$DU \geq 97.0\%$
AB	$A^d \leq 0.6\%$	$DU < 97.0\%$
B	$0.6 < A^d \leq 1.0\%$	$DU \geq 97.0\%$
BC	$0.6 < A^d \leq 1.0\%$	$DU < 97.0\%$
C	$1.0\% < A^d \leq 2.0\%$	$DU \geq 97.0\%$
CD	$1.0\% < A^d \leq 2.0\%$	$DU < 97.0\%$
D	$2.0\% < A^d \leq 3.0\%$	$DU \geq 97.0\%$
DE	$2.0\% < A^d \leq 3.0\%$	$DU < 97.0\%$
E	$A^d > 3.0\%$	$DU \geq 97.0\%$
EF	$A^d > 3.0\%$	$DU < 97.0\%$

Table 2.4 Pellets classification, considering their physical properties (based on fuel proximate analysis) – according to fuel evaluation methods, developed and applied in boiler's producer company;

where:

A^d – *ash contents, dry basis*, [%];
DU – *mechanical durability*, [%];

The European wood pellets standard EN 14961-2:2010 defines wood pellets certificate ENplus for pellets, utilized in boilers and appliances for domestic heating systems. The certificate EN-B is applied for pellets, utilized in industrial boilers. In principal the ENplus standard defines two quality classes: A1 и A2. The class A1 is highly restricted, considering the ash content. The class A2 the limit of the ash content of the wood pellets is higher – up to 1.5%. For industrial boilers the certificate EN-B is applicable, which defines fewer restrictions on the pellets quality.

Parameter	**Dimension**	**ENplus-A1**	**ENplus-A2**
Diameter	mm	6 (± 1)	6 (± 1)
Length	mm	3,15 ≤ L ≤ 40 [1)]	3,15 ≤ L ≤ 40 [1)]
Bulk density	kg/m³	≥ 600	≥ 600
Low calorific value	MJ/kg	≥ 16.5	≥ 16.5
Moisture content	%	≤ 10	≤ 10
Dust	%	≤ 1 [3)]	≤ 1 [3)]
Mechanical durability	%	≥ 97.5 [4)]	≥ 97.5 [4)]
Ash content	% [2)]	≤ 0,7	≤ 1.5
Ash melting point temperature	°C	≥ 1200	≥ 1100
Cl	% [2)]	≤ 0.02	≤ 0.03
S	% [2)]	≤ 0.05	≤ 0.05
N	% [2)]	≤ 0.3	≤ 0.5
Cu	mg/kg [2)]	≤ 10	≤ 10
Cr	mg/kg [2)]	≤ 10	≤ 10
As	mg/kg [2)]	≤ 1	≤ 1
Cd	mg/kg [2)]	≤ 0.5	≤ 0.5
Hg	mg/kg [2)]	≤ 0.1	≤ 0.1
Pb	mg/kg [2)]	≤ 10	≤ 10
Ni	mg/kg [2)]	≤ 10	≤ 10
Zn	mg/kg [2)]	≤ 100	≤ 100

1) not more that 1% of the wood pellets should be with length of 40 mm, the maximal pellet length is 45 mm ;
2) determined on dry mass;
3) the particles are <3.15 mm, fine particles, before fuel delivery;
4) in case the test measurements are performed with Lignotester, than the limit value is ≥ 97.7% m.w.;

Table 2.5 ENplus - European standard for wood pellets;

3. Description of hot water pellet boiler of series "Pelletherm v2".

The heat exchanger of the boiler complies with the acting requirements for such kind of units, defined in operating norm: *EN 303-5/2000 – „Heating boilers for solid fuels, hand and automatically fired, nominal heat output up to 300 kW. Terminology, requirements, testing and marking".*

The unit consists of:

- Main part of the unit is **heat exchanger**. In the combustion chamber of this exchanger is mounted specialized grate burner, designed for horizontal fuel feeding;
- **The heat exchanger** is welded construction of carbon steel plates and steel pipes. The lower part of the exchanger is designed as combustion chamber. The burner is mounted in this chamber and conditions efficient combustion process;
- **High temperature stainless steel burner,** mounted in the combustion chamber of the heat exchanger;
- **Ash container,** positioned in the lower part of the combustion chamber, below the burner;
- **Fuel hopper** is mounted aside of the boiler's heat exchanger. Beneath the hopper is mounted a fuel-auger separator (which also acts as fuel proportioner), followed by horizontal transport auger. The fuel proportioner prevent the so called "back fire" process, i.e. ignition of the fuel in the hopper by the hot flue gases in the auger duct in case of abnormal situations;
- **Fresh air fan** is mounted on the air duct of the burner. The fan is equipped with position adjustable flap in order to set the air flow rate. Additionally the air duct is equipped with flaps for individual adjustment of the primary and secondary air flow rates. These flaps are factory set and in principal need no adjustment;
- **Inflow and outflow connections (to/from the heating system)** of the supply and return circulating water are internal threads, positioned in the rear side of the heat exchanger;
- **Draining connection** is internal thread, diameter G½" and is positioned on the lower part of rear side of the heat exchanger. An appropriate drainage valve should be connected;

- **Flue gases exit duct** is positioned in the upper rear side of the heat exchanger (after the flue gases fan, concerning the flue gases track), utilized for forced flue gases extraction;
- **Boiler's heat exchanger** is covered with decorative covers, isolated with mineral wool plates, ensuring low heat losses to the ambient environment;
- **Outer decorative covers** are carbon steel plates color painted details;

Figure 3.1 External view of hot water pellet boiler of series "Pelletherm v2";

The unit is designed and assembled in two main modules – the heat exchanger (the left one) and the fuel hopper module (the right one). These modules are easily detachable and could be assembled onsite if necessary;

The producer reserves the right to make changes of the design of the hot water boiler of series "Pelletherm v2" without obligations to inform the clients for that process.

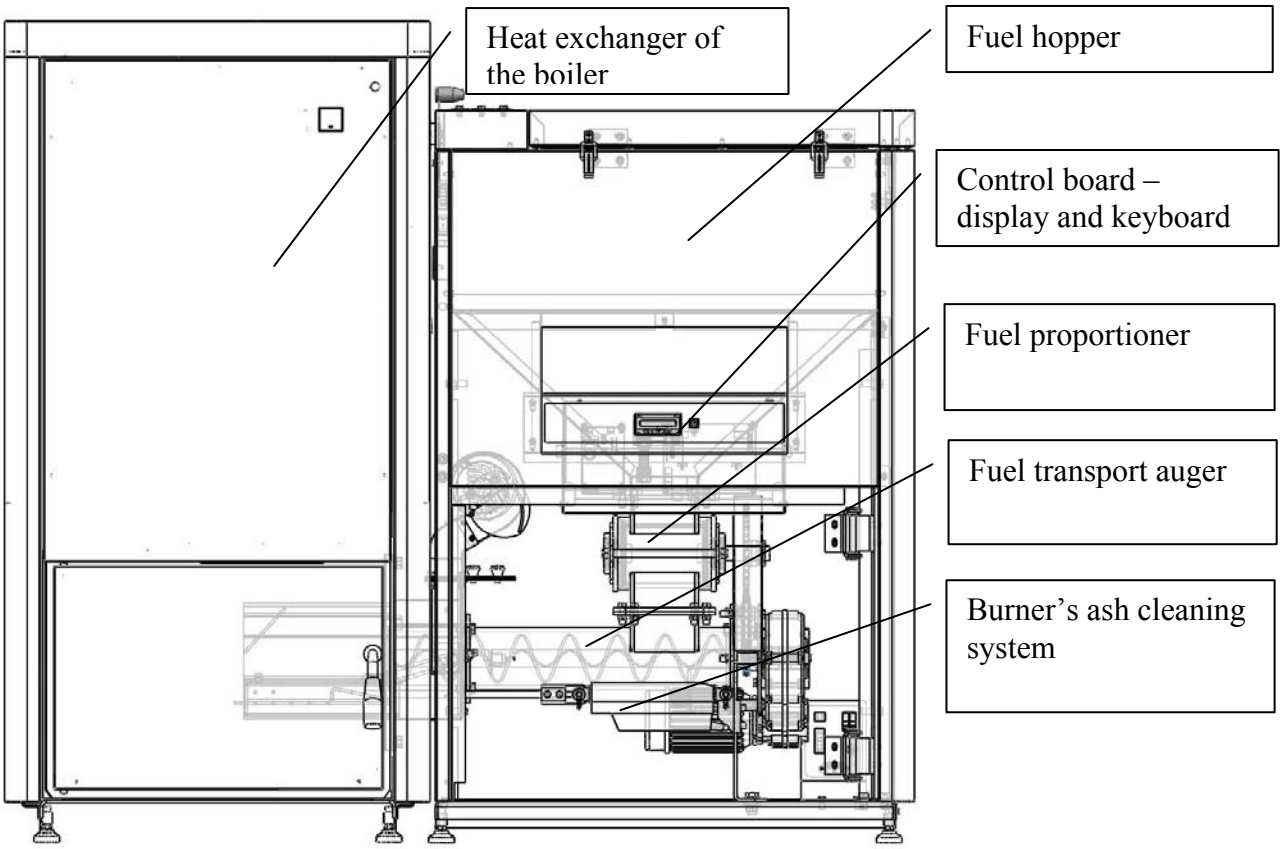

Figure 3.2 Partly sectioned view of hot water pellet boiler of series "Pelletherm v2 M01" – *front view*;

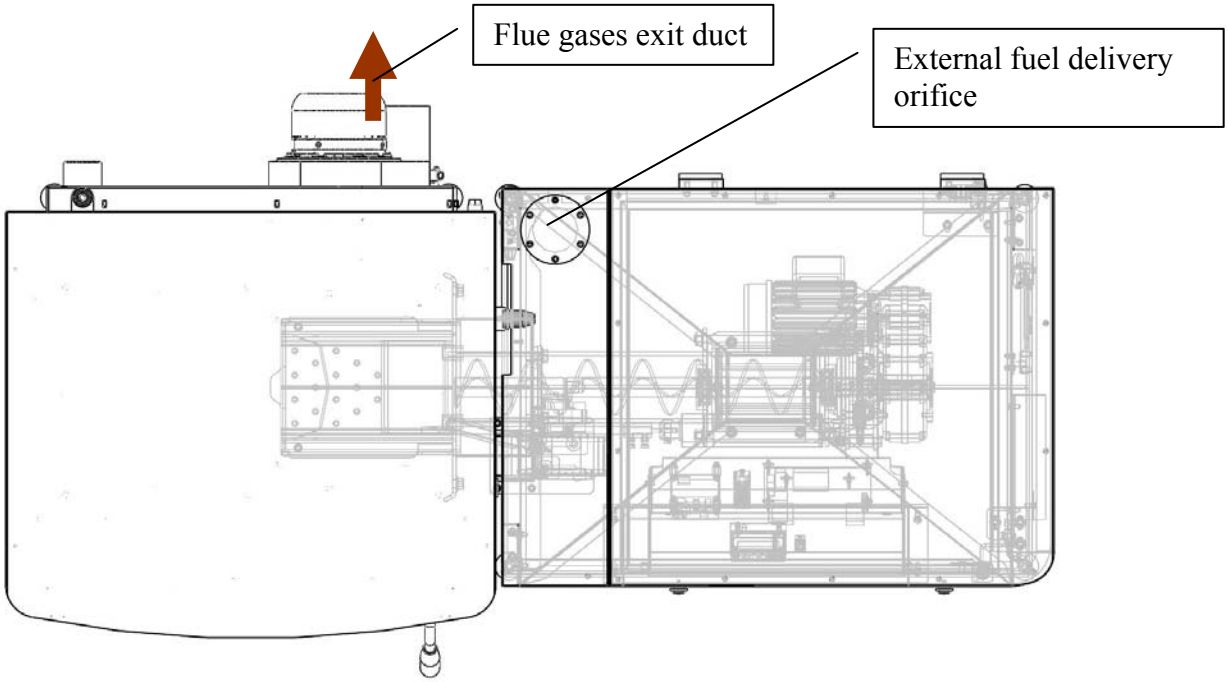

Figure 3.3 External view of hot water pellet boiler of series "Pelletherm v2" – *top view*;

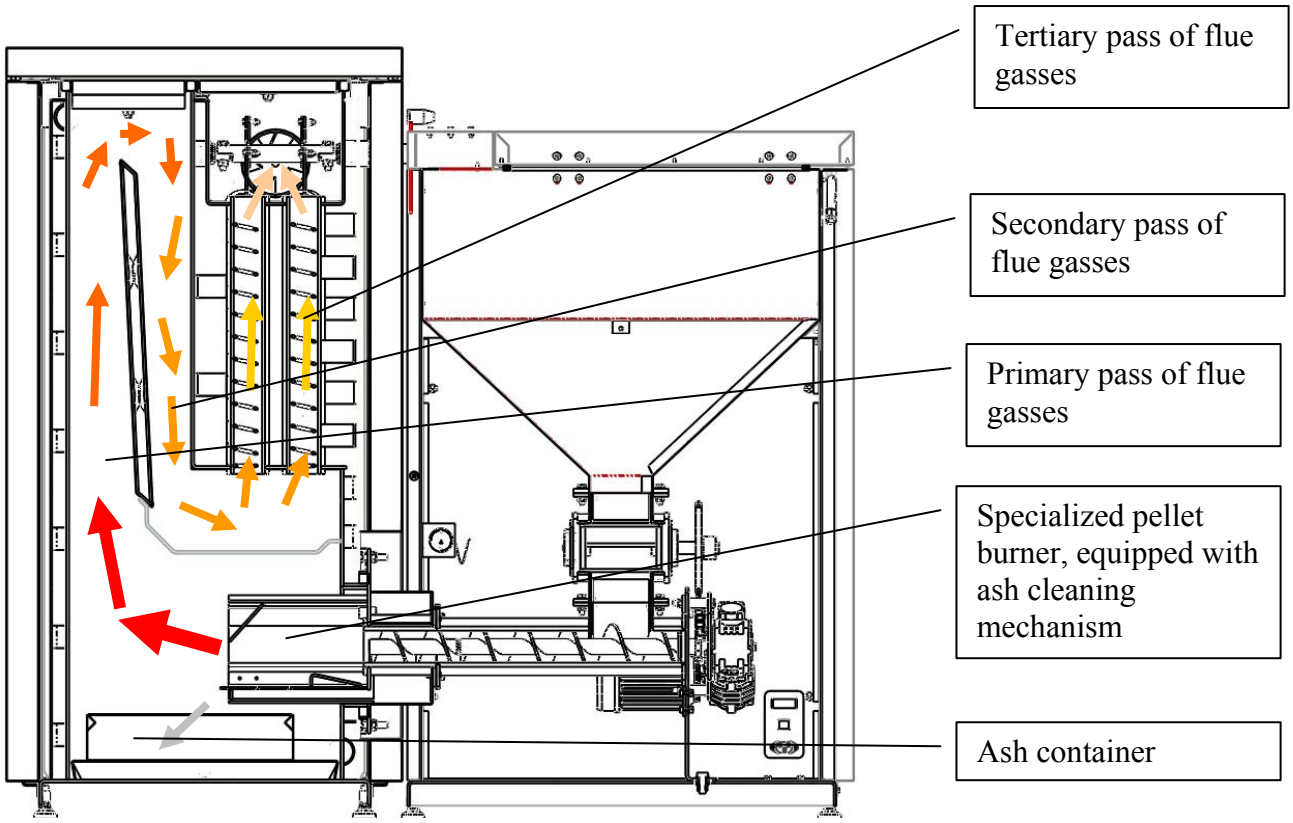
Tertiary pass of flue gasses
Secondary pass of flue gasses
Primary pass of flue gasses
Specialized pellet burner, equipped with ash cleaning mechanism
Ash container

Figure 3.4 Cross section view of hot water pellet boiler of series "Pelletherm 30 v2". The flue gasses duct and streamlines are visualized as well;

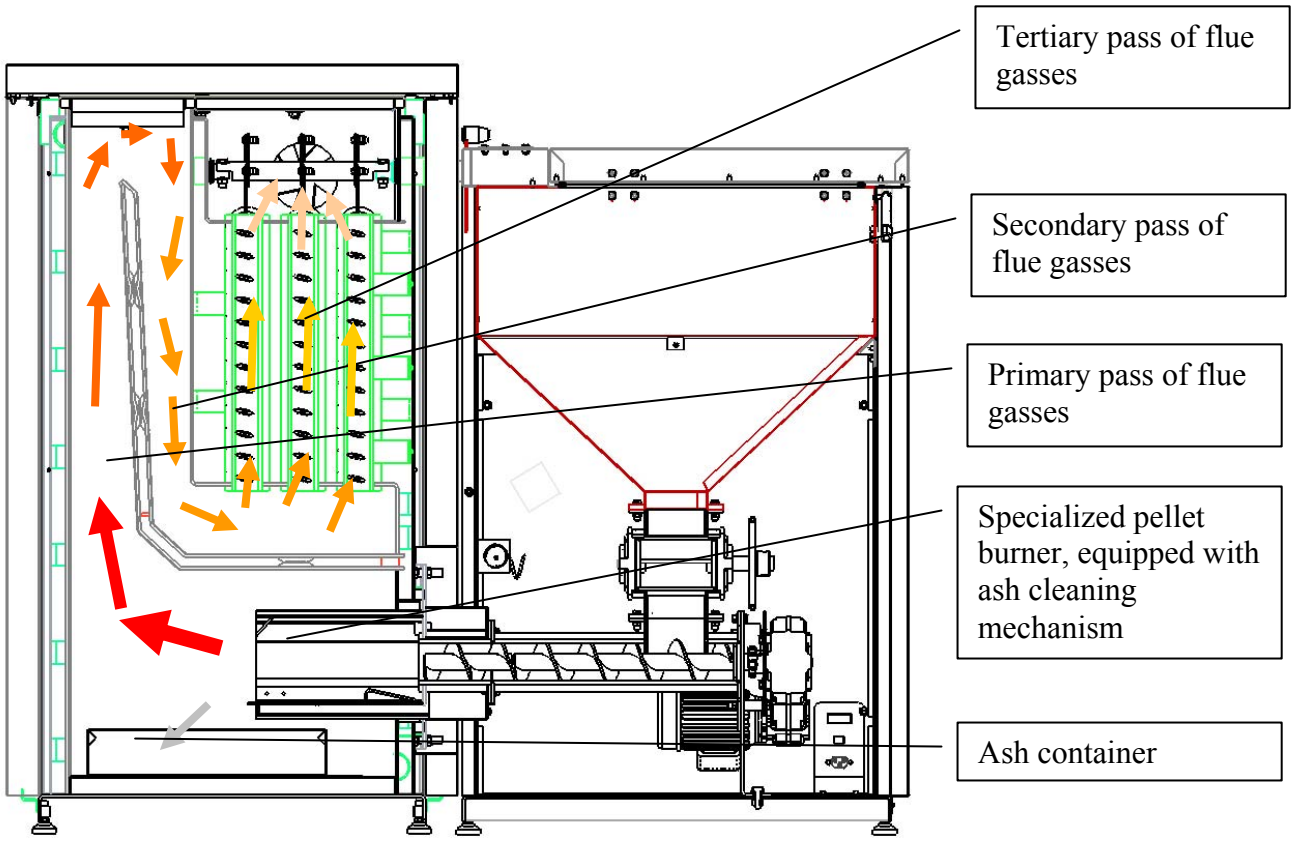
Tertiary pass of flue gasses
Secondary pass of flue gasses
Primary pass of flue gasses
Specialized pellet burner, equipped with ash cleaning mechanism
Ash container

Figure 3.5 Cross section view of hot water pellet boiler of series "Pelletherm 45v2". The flue gasses duct and streamlines are visualized as well;

4. Installation process.

Norms and recommendations.

Basic requirements for installation of hot water pellet boiler of series "Pelletherm v2":

- The room, dedicated to mount the boiler, should be supplied with fresh air supply duct, necessary for optimal combustion process as well as room ventilation;
- Installation of the unit in inhabitable premises, including dwelling corridors, is not allowed;
- The hot water boiler should be connected to the heating system by authorized personal only;
- Installation and service procedures of solid fuel hot water boilers should be performed by authorized qualified and certified personal ONLY;
- The hot water pellet boiler of series "Pelletherm v2" should be connected to heating system, supplied with **OPENED** or **CLOSED** expansion vessel. In case the heating system is equipped with **closed** expansion vessel, then the system should be equipped with over-pressure safety valve, which opens at pressure exceeding the operating one of the hot water boiler (0.25 MPa) and this overpressure safety valve should be certified according to PED 97/23;
- Both the entire heating system and the boiler should be totally filled with circulating fluid (water) and air-free before operating the boiler;
- Maintenance procedures of the boiler should be performed by trained adult persons, which have read the user manual of the unit;

Installation procedure of the boiler requires engineering project for the heating system, prepared according to the acting local norms and recommendations as follows:

- To the heating system - EN 303-5/2000 - „*Heating boilers. Part 5: Heating boilers for solid fuels, by hand and automatically fired, nominal heat output of up to 300 kW. Terminology, requirements, testing and marking*";
- To the chimney;
- Fire prevention requirements;
- To the power circuit - EN 60335-1/1997- "*Household and similar electrical appliances – safety, Part 1 – General requirements*";

- Appliance positioning in order to achieve comfortable maintenance.
    - Minimal distance of 1000mm in front of the unit and any wall should be provided;
    - Minimal distance of 400mm from the rear wall of the unit and any wall should be provided;
    - Minimal distance of 500mm from the right hand side of the unit and any wall should be provided, in order to guarantee easy access to the fuel transporting auger;
    - Minimal distance of 300mm from the left hand side of the unit and any wall should be provided, in order to guarantee easy access at servicing of the flue gas fan of the unit;
    - Minimal distance of 500mm above of the unit and any ceiling(wall) should be provided, in order to guarantee easy access to the fuel's hopper, as well as enough room for cleaning purposes of the heat exchanger body as well as fuel hopper charging;

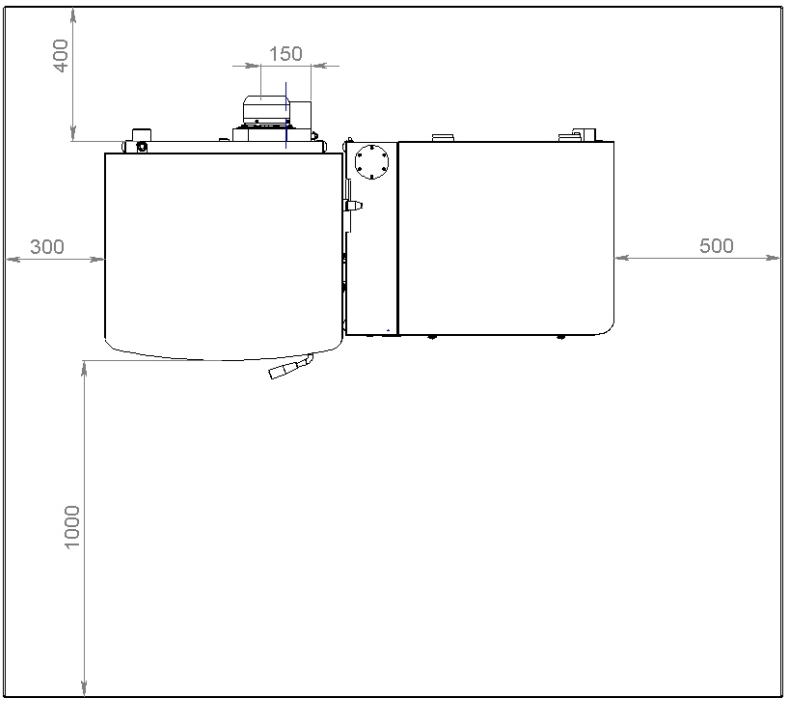

Figure 4.1 Positioning of hot water pellet boiler of series "Pelletherm v2" – the minimal distances between the unit and any walls/obstacles of the boiler's room are shown;

- The hot water boiler should be positioned in the boiler's room according to the requirements for attaching electrical appliances to the power circuit – the unit should be positioned in a way, that will provide easy access to the power supply plug (230V/50Hz);

ATTENTION: *the installation process of the boiler is finalized by performing so called "hot tests" procedure of the heating system and the warranty card is filled with the required information.*

The recommended principal hydraulic scheme for connecting the hot water pellet boiler of series "Pelletherm v2" to the heating system is snow on the following figure.

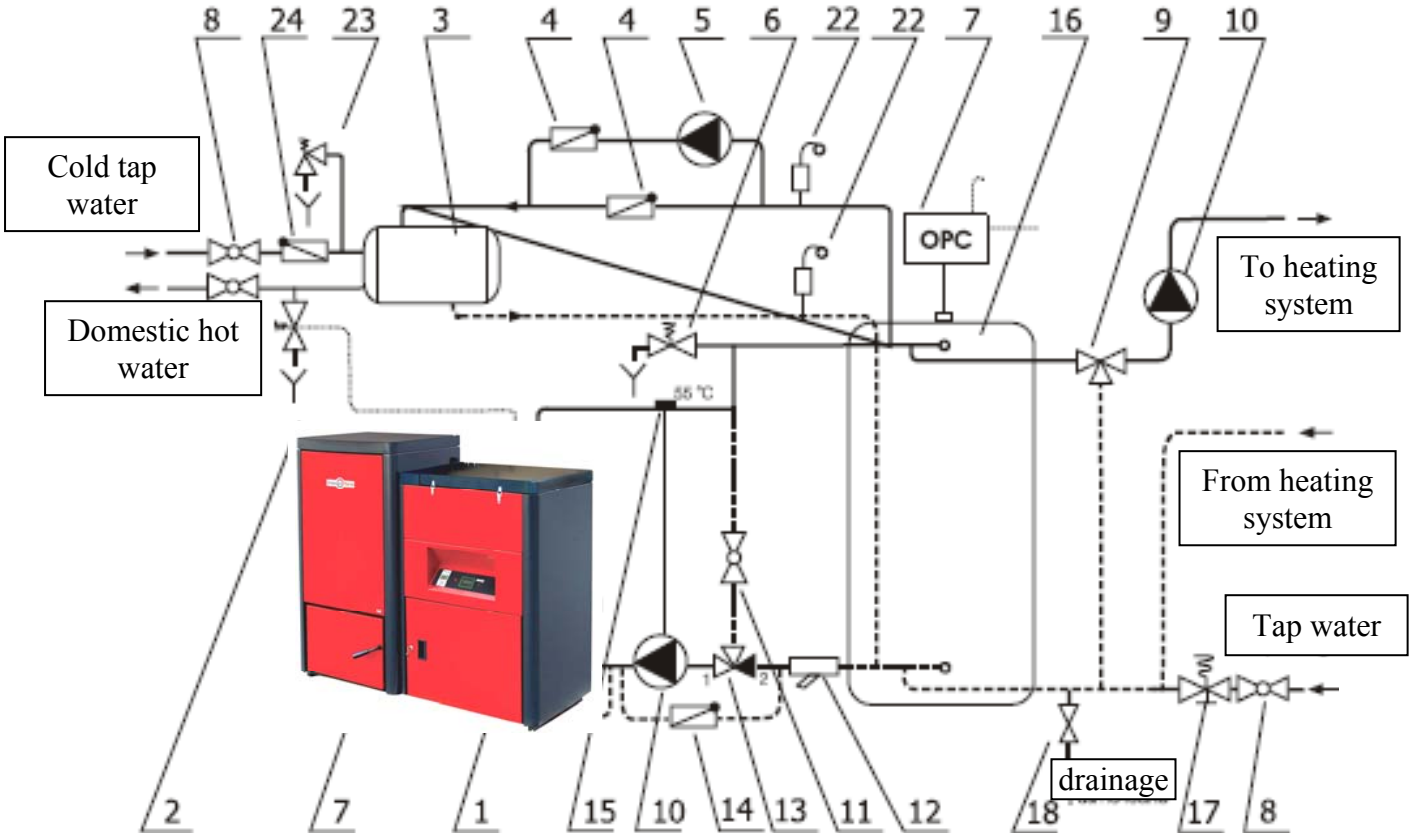

Figure 4.2. Recommender principal hydraulic scheme for connecting the hot water pellet boiler of series "Pelletherm v2" to the heating system, equipped with mixing valve and heat accumulator;

Index	Designation
1	Hot water boiler of series "Pelletherm v2"
2	Safety valve
3	Hot water boiler
4	Return valve
5	Circulating pump 1
6	Control valve
7	Expansion vessel
8	Control valve
9	Three way mixing valve
10	Circulating pump 2
11	Control valve

Index	Designation
12	Water filter
13	Thermovalve TV
14	Return valve
15	Contact thermostat
16	Heat accumulator
17	Automatic circulating water charger
18	Drainage valve
22	Automatic air separator
23	Safety valve
24	Return valve

Table 4.1. Designation of the elements, indexed on figure 4.2

NOTE : *According to EN 303-5 the heat accumulator is obligatory module of a heating system, equipped with solid fuel hot water boiler. The dimensioning of the heat accumulator tank is described in the above mentioned standard. The boiler producer could assist in appropriate designing of that module as well.*

4.1. Hot water pellet boiler connection methodology

4.1.1. Connecting to the chimney

After the boiler has been positioned and leveled (utilizing the leveling screws, installed in the lower corners of the heat exchanger as well as the fuel hopper module), the unit should be connected to an appropriately sized and designed chimney.

4.1.2. Connecting to the heating system

After the flue gas duct of the boiler is connected to a chimney, the boiler should be connected to the heating system – *utilize appropriately sized fitting, according to the preliminary prepared project*.

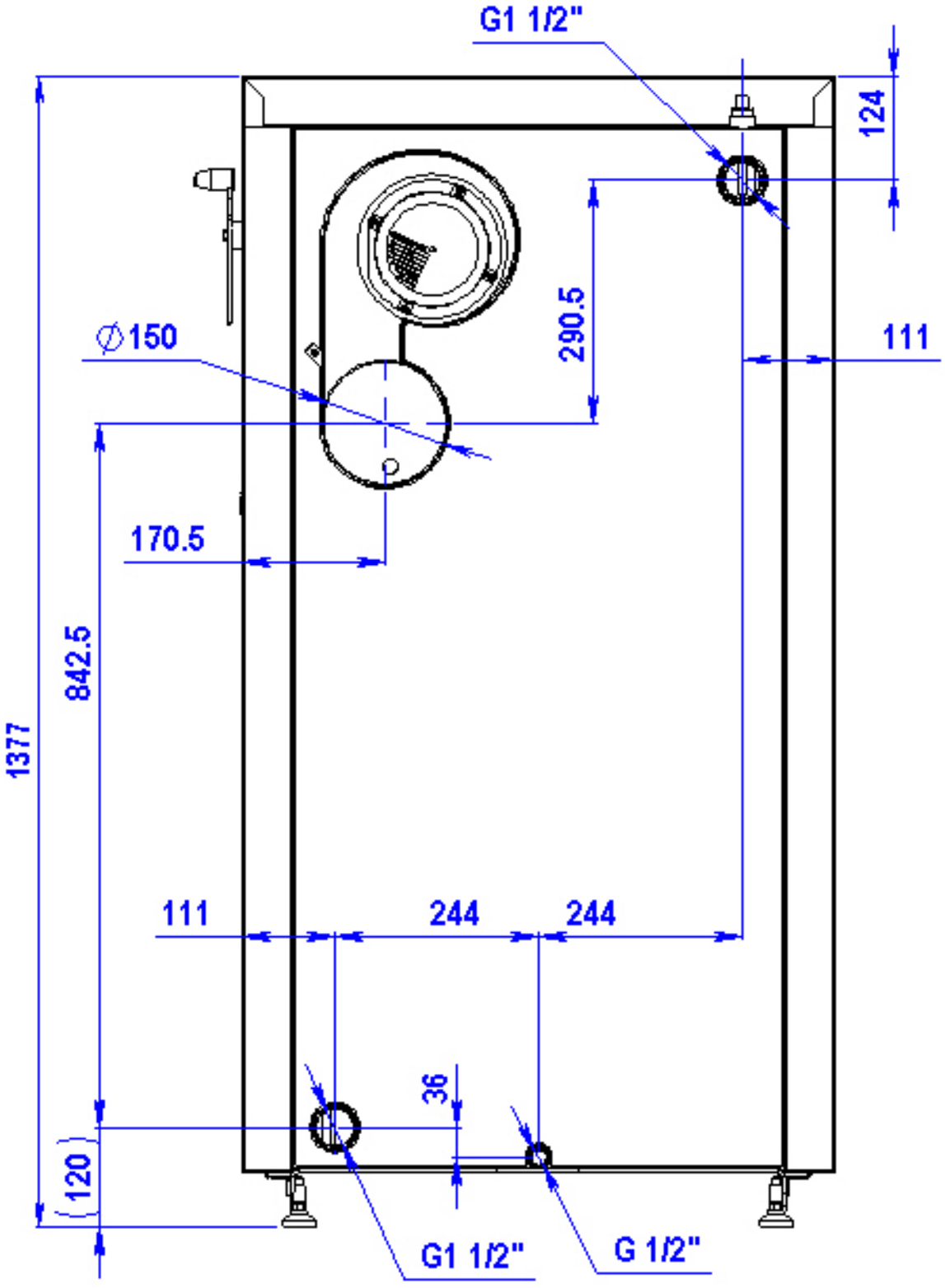

Figure 4.3. Back side view of heat exchanger connections of hot water pellet boiler “Pelletherm 30 v2”;

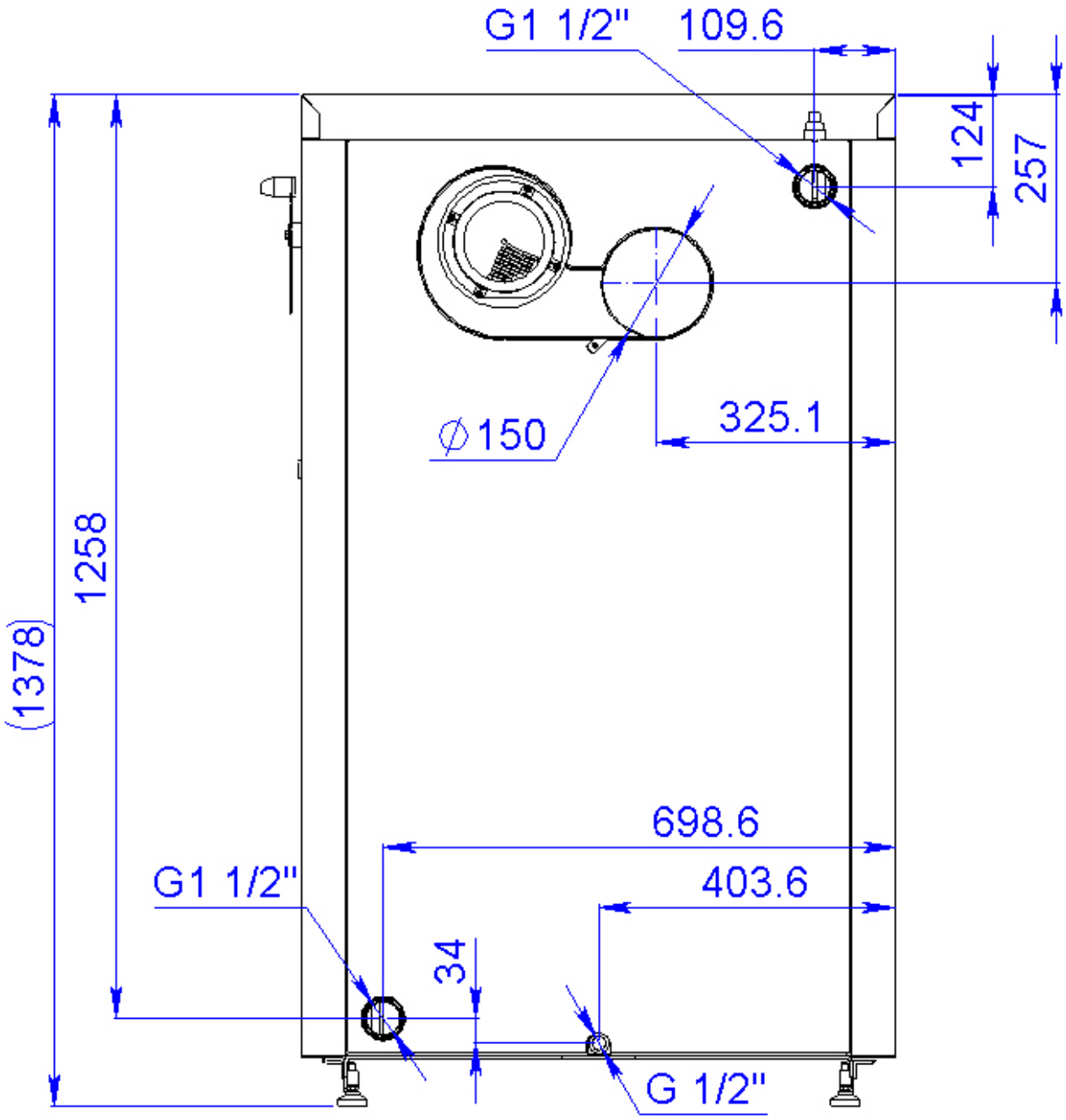

Figure 4.4. Back side view of heat exchanger connections of hot water pellet boiler “Pelletherm 45 v2”;

5. Hot water boiler installation and starting procedures.

ATTENTION : The unit should be installed, adjusted and verified ONLY by trained and authorized staff.

5.1. Basic fuel requirements.

- The fuel, pellet shaped, should be dry. The unit producer recommends that the fuel should be stored in dry and well ventilated rooms;
- It is strongly forbidden to store the fuel in close region of the boiler, the minimal safety distance between the fuel and the appliance is 400 mm;
- The unit producer recommends an optimal distance between the boiler and the fuel container to be at least 1000mm. It is recommended to store the fuel in room, next to that, where the boiler is installed;
- At the installation procedure of the unit, as well as the fuel storage one, fire prevention recommendation should be considered. It is also recommended to install a fire-extinguisher in a safe and easy accessible place;

In principle heating systems, which are hydraulically opened to the atmosphere allow direct contact between the circulating fluid (in most cases it is water) and the air. During the heating season the water content in the expansion vessel absorbs oxygen from the atmosphere though the free surface. The increased oxygen content in the water threatens the metal of the unit, as well the pipes. Through the free surface of the expansion vessel water evaporation is observed as well. Considering these, appropriate water should be added through the expansion vessel – it must cover the requirements of norm BDS 15207-81.

During the heating season regular checking of circulating water level in the expansion vessel should be performed by the end user. The water content in the circulating system should be kept constant. If additional water is required, then precautions should be taken, not to add air in the heating system as well. The water, utilized for filling purposes of the heating system should be decontaminated and air-free, and is not dedicated for any other purposes, but as a circulating fluid only. Any heating system drainage is inadmissible, except when repairing modules/sections of the system. Practical experience shows that water level checkup should be performed regularly in a period of 14 days in order to sustain quasi-constant water content.

In case that additional water is required, the filling process should be performed carefully, when the hot water boiler is cooled to the ambient

temperature. This precautions are induced due to prevent rising of thermal stress of the steel boiler's body and its damage (leakage).

In case that the boiler as well as the heating installation will not be in exploitation for a long period, then in order to prevent local water freezing and damages, it is advisable to perform total drainage of the circulating water. Please take into account that the presence of liquid in the heating system, as well in the boiler will prevent oxidation process of the metal surfaces, corrosion and system failures.

5.2. Starting hot water boiler of series "Pelletherm v2" procedure.

Basic requirements:

- Any maintenance procedures should be performed in accordance with the described in this manual;
- Any intervention in the working process of the unit, which could lead to unit's failure and/or dangerous and health threatening situations, are strongly prohibited;
- The unit should be checked by the maintenance staff or any trained personal regularly;
- The end-user should not perform any interventions, repairs, etc. of the unit. In case that warning and failures arise, check the failures table (applied at the end of this manual) and call the service support if the case is not described there;
- Any adjustments of thermal capacity higher than the nominal thermal load of the units are not allowed;
- The ash, deposited in the combustion chamber of the boiler, should be collected in fireproof containers and cooled down to ambient temperature. The cooled ash should be disposed in appropriate waste containers. Please take into account that the mineral ash, result of wood biomass pellets could be considered as soil fertilizer and dispersed for agricultural purposes for example;
- The door of the fuel hopper section of the boiler is equipped with a safety switch and in case the door is opened, then the motor of the fuel transport auger will be powered off for safety reasons – this door should be kept closed;

5.2.1. Interface control board of hot water pellet boiler of series "Pelletherm v2 M01"

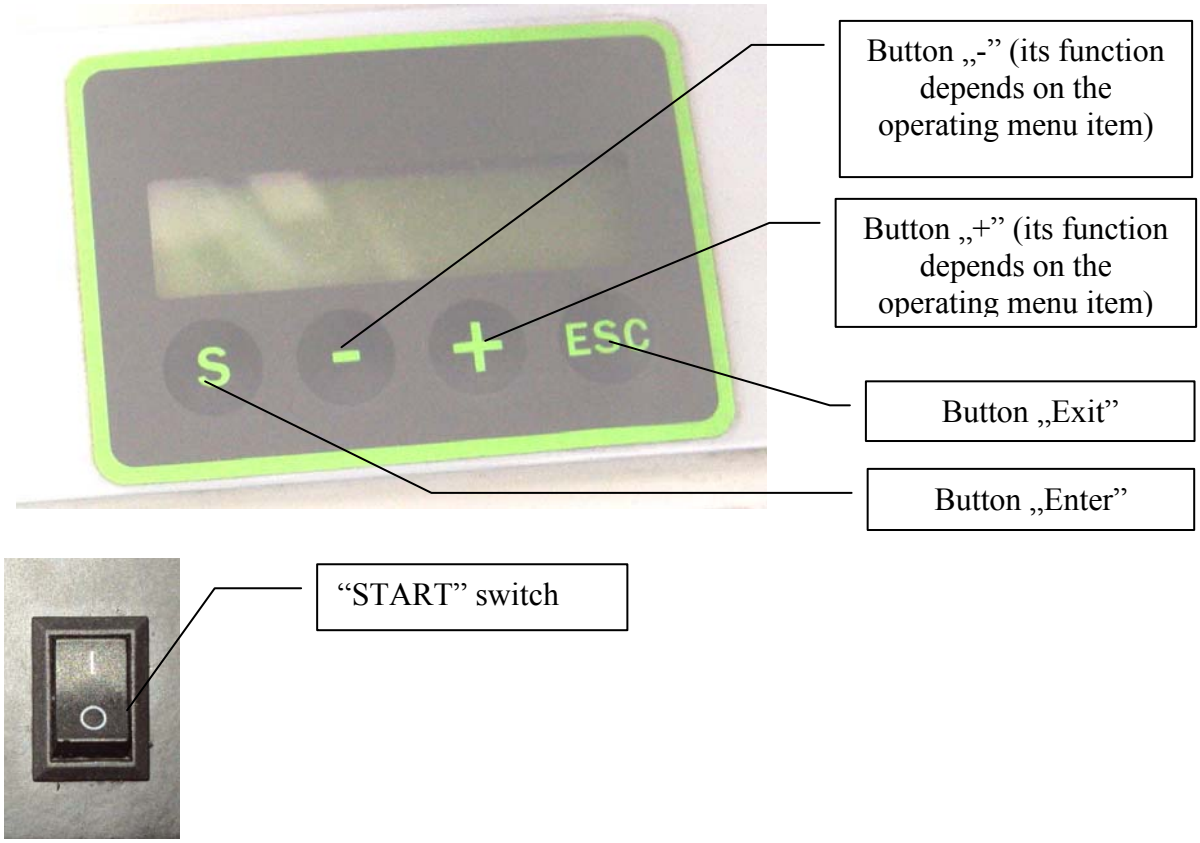

Figure 5.1. Interface board, LCD display and keyboard for control and monitoring of the hot water pellet boiler of series "Pelletherm v2 M01".

Interface control board devices description:

- Button „ **S** " – selects the menu item and for confirmation of any changes;
- Button „ - " – decreases the value of operating parameter of the burner's controller;
- button „ + " – increases the value of operating parameter of the burner's controller;
- Button „ **Esc** " – rejects any change of operating parameter, also exits from operating item of the controller's menu;
- "**START**" switch – *sends "START/STOP" signal to the process control module;*
- **Emergency thermostat** – *protects the boiler from exceeding emergency temperature level and boiler overheating. This thermostat is factory preset to switch off the unit at water temperature in the boiler above 95^{o}C*;
- Main "**POWER**" switch – *switches ON and OFF the main power supply of the boiler*;

NOTE: *the described buttons could have other functionality, which is dynamically indicated on the display of the controller*.

5.2.2. Hot water boiler power supply.

- The boiler should be connected to the chimney according to the installation's project. This duct should be sealed and verified that there is no flue gases leakage;
- The boiler should be connected to the heating system, the system, as well as the water jacket of the heat exchanger should be filled with circulating liquid, free of air, the control modules (valves, pumps, motor-valves, etc.) should be checked for functionality as well;
- The unit should be connected to the main power supply, according to the safety rules and appropriate norms;
- The hopper should be filled with pellets, in order to transport fuel material by the pellet feeding auger to the burner. It's recommended to set the pellet hoper lid closed, in order to preserve uncontrolled air penetration to the combustion chamber through this tract;

The boiler's main "**POWER**" switch is positioned on its back side, it switches ON and OFF the main power supply of the boiler.

5.2.3. Hot water boiler very first start.

The unit is switched on by the main "POWER" supply switch. The unit gets activation signal by switching ON the "START" and goes into automatic operating mode – it goes through ignition mode if needed. If the "START" switch is OFF then the boiler goes into stand-by mode and waits until new command arise. In case of power supply break-down the boiler will go into the same state of the unit before the interruption.

ATTENTION : *During the operation of the boiler when the door of the combustion chamber is opened, it is possible to observe smoke leakage through the transport auger tract as well as the pellet hopper. Because of these reasons the opening of that door is not recommended. The same processes could be observed at the transition periods – during spring and autumn seasons, when the chimney's draught is reduced due to high ambient temperature.*

COMMENTS:

- *At the period of fuel ignition an electrical heater is activated. The heater will be deactivated when there is combustion process in the combustion chamber, monitored by a photosensor;*
- *During the very first starting period of the unit it takes time to fill the auger volume with fuel. According to the settings of the unit the first ignition may fail. If this is the case, please restart the unit (by switching OFF and ON by the main "POWER" switch) and check the ignition process gain;*
- *The boiler is operating, controlled by predefined algorithm, loaded in the process control module;*

5.2.4. Boiler's operating algorithm

The boiler starts its nominal operation if the following conditions are fulfilled:

- Available power supply;
- Activated "START" , indicated on the control module's display or presence of signal to operate – *in case the boiler is controlled by remote room programmable thermostat*;
- No alarm signals are available;
- The boiler's fuel transport auger is charged and filled with fuel and its bunker is charged with fuel as well;

If the above described conditions are satisfied, then the control board performs algorithm as follows:

- The fuel transport auger is activated, the electric heater is activated and the fans are running simultaneously;
- After a factory set (predefined) period of time has ran out, (during this period the so called "initial fuel" mass has been charged to the combustion chamber), the electric motor of the fuel transport auger will be stopped (the ignition heater is active however);
- After certain period of time the photosensor of the boiler should recognize stable combustion process by the emitted visible light and the electrical ignition element will be powered off. This is followed by graduate increment of the thermal capacity (i.e. the fuel flow rate) of the boiler and after certain period of time the nominal thermal capacity will be reached. In case that the photosensor does not sense intensive light, i.e. there is no combustion process, or it is rather lean, than the control board of the boiler will initiate new attempt to start the unit, the above described algorithm will be repeated. The total number of ignition attempts is however limited. In case that this limit has been passed, then boiler will go into alarm mode and will not function until manual

assistance is performed (for example bunker's charge with fuel, solving a problem, etc.) and the boiler is restarted;

- In case that the fuel has been ignited, the boiler goes into nominal operation mode, which is performed by periodic fuel transport to the combustion chamber of the boiler, followed by a certain interval, utilized for fuel combustion. The periods for fuel charge and combustion are predefined in the operating firmware of the control module, the thermal capacity of the boiler is however changed by setting the operating stage of the boiler;

  ATTENTION: *The choice of the maximal thermal capacity stage – 5th is not recommended, this stage is available in order to utilize relatively low calorific value fuel or temporary demand of increased heat consumption rate. It is recommended to operate the boiler in the operating range of 1st to 4th thermal capacity stages, at 4th stage the boiler achieves its nominal thermal capacity;*
- At approaching the temperature of the boiler's circulating water set-point the control module decreases the boiler's operating thermal capacity (i.e. the control module operates the boiler in modulating mode);
- At decreasing the temperature of the circulating water, the boiler's control module restores the set thermal capacity;
- In case that the "START" signal goes off (for any reason – room thermostat for example, etc.) the boiler will go into stand-by mode, following the algorithm, described above;
- In case that in stand-by mode the boiler receives "START" signal, the control board will perform the above described algorithm in order to initiate ignition and continue into nominal thermal capacity mode; The same operating algorithm will be performed when the temperature of the circulating water is below the temperature set-point;
- In case the first fuel dose is not ignited due to any reason, the control board of the unit will automatically start new ignition procedure. The total number of ignition attempts is limited to 2 (factory preset value). In case of two failures at ignition, there could be fuel particles on the burner's grate, which should be cleaned. ATTENTION : if the accumulated fuel is not cleaned after ignition failures, any new attempt to ignite the fuel particles will be accompanied with intensive smoke release and eventually blast ignition, which could eventually result even in mechanical damages of the boiler as well as the chimney duct;
- In case that during nominal operation the photosensor does not recognize active combustion process, the initial fuel ignition procedure is started automatically;

- In case the total number of ignition attempts has been exceeded, for example when the fuel in the boiler's hopper has been consumed, the boiler will go into alarm mode and the control module's display will indicating that manual assistance and restart of the unit is required as well. After the reason for alarm mode has been clarified and overcome, the boiler should be restarted by switching it OFF and back ON the main power supply switch.
  ATTENTION : *before starting up the boiler it is necessary to check if the grate of the burner contains unburned/raw fuel and ash, if available these residues should be cleared away, also clean any ash residue in order to achieve optimal combustion process*;
- In case that the power supply has been interrupted, at its renewal the boiler will continue its operation automatically;

  ATTENTION: *at operation the boiler periodically goes into final combustion mode and after combustion ash cleaning procedure is activated, controlled by the „Makc.comb.time" operating parameter. This parameter is in the „Advance menu" (restricted for authorized technicians only with a password);*

5.2.5. Operating control parameters of the boiler of series "Pelletherm v2 M01"

The control board of the boiler has factory preset operating parameters values, which in common case are satisfying the requirements of a unit and does not require any intervention and variation. The optimal operating conditions, however are achieved by setting the thermal capacity stage of the boiler. The practice however confirms, that the appropriate choice of the thermal capacity stage of the boiler in order to achieve continuous operation of the unit, allows optimal operating conditions and optimal fuel consumption rate.

The control module's display and the keyboard are used to indicate the current status of the boiler, as well as adjustment of its operating parameters. The adjustment of the parameters however, should be performed by authorized trained technician only.

5.2.6. Description of the initial menu, the starting process and the adjustment of the control module of boiler of series "Pelletherm vv M01"

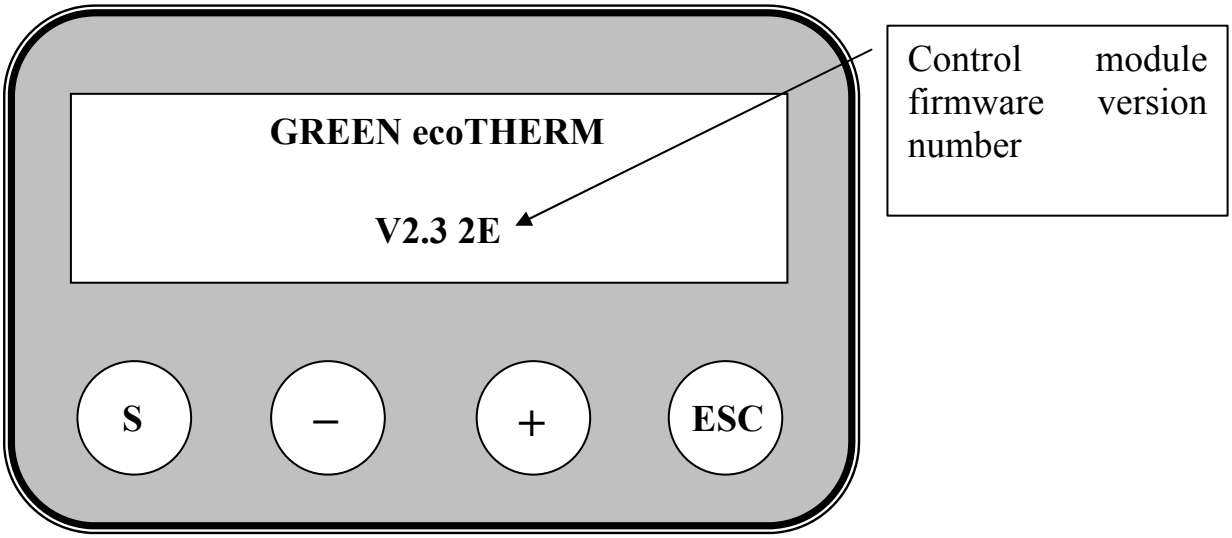

Figure 5.2. Initial menu, shown on the boiler's display of series "Pelletherm v2 M01" start-up process.

After the boiler's software has been loaded into the control module (which actually takes several seconds), the display indicates a question: ***should the boiler be activated (*Activate ?*)*** :

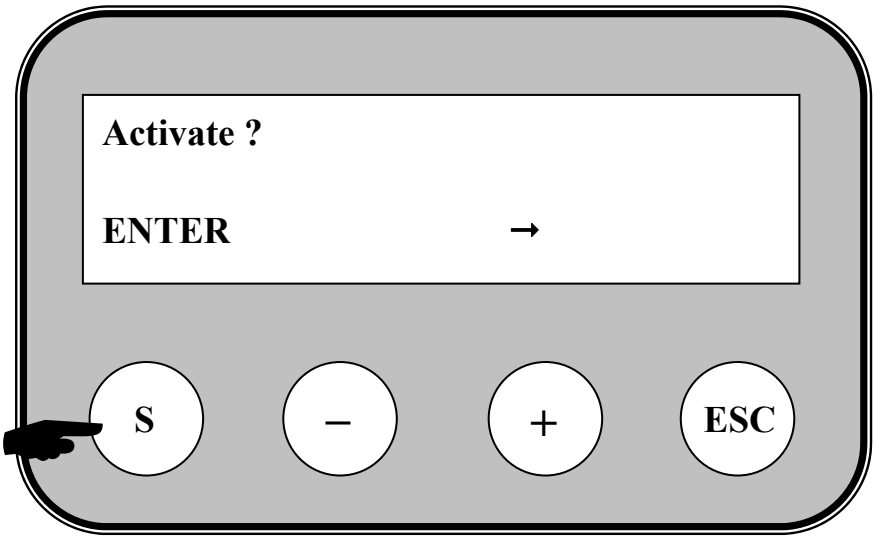

Figure 5.3. Menu item shown on the display at start-up procedure of the hot water boiler of series "Pelletherm v2 M01", indicating reminding question.

In order to start the boiler, press the button "S", as shown on the figure above.

After the boiler has been activated, the display indicates the following message.

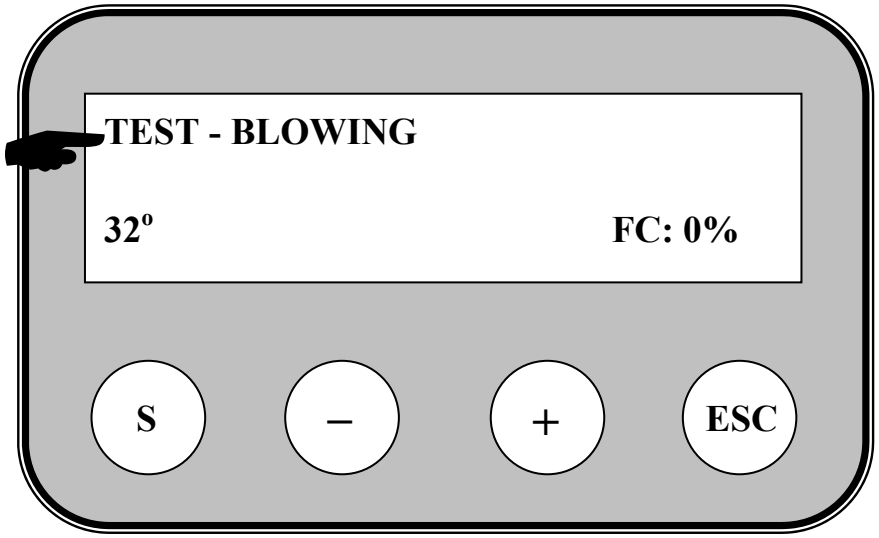

Figure 5.4. The display indicates information for the current operating mode of the control module – *in the case the control module performs functional check procedure of the fans*.

COMMENTS :

- **„TEST – BLOWING " –** indicates the operating mode – in the example the control module performs initial air fan blowing, which is dedicated to blow away any residues on the burner's grate;
- **„ 32° " –** indicates (*shown on the display, in the lower right corner, above the "S" button*) the temperature of the boiler's circulating water, in degrees Celsius;
- **„FC: 0% " –** indicates the intensity of the luminosity of the photosensor, in percents – *the current value is indicated in the lower right corner of the display, above the button „ESC"*;

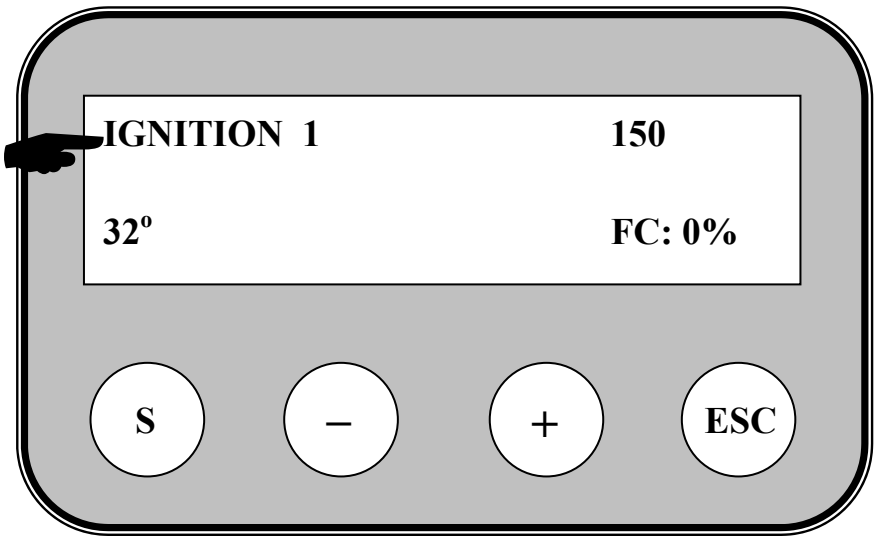

Figure 5.5. The display indicates information about the operating mode of the boiler – in the example the control module is in fuel ignition process mode.

COMMENTS:

- *After the initial ash residue air blowing by the fan, the control module of the boiler starts to supply the initial amount of fuel and starts the process of fuel ignition. The display indicates the operating mode „**IGNITION 1**" – this is the first attempt (indicated by number 1) for fuel ignition, which is realized for a duration, defined in the operating software;*
- *The control module of the boiler is preprogrammed in the producer's factory with factory default values for the operating parameters, considered to be optimal for most of the common cases of boiler's operation. The control module operates at discreet thermal capacity stages, which are adjusted to predefined thermal capacities of the unit. The maximal thermal capacity stage, however, is adjusted to allow higher thermal capacity of the boiler, than the nominal one – this stage is dedicated for cases of low quality fuel (i.e. with lower than required net calorific value of the fuel) or in case the heat demand exceeds the thermal capacity of the boiler. It is recommended to operate at the highest thermal capacity stage no more than 10 hours for the entire heating season, in order to sustain high reliability of the boiler, as high thermal capacity operating modes result in increased thermal loads of the modules of the unit and decrease its life span;*
- *The practice shows, that the factory set values for the operating parameters does not require additional adjustment, even if the fuel has been changed during the exploitation period of the boiler;*

The producer reserves the right to change the values of the operating parameters of the hot water boiler's control module without prior notice;

NOTES :

- The values of the operating parameters, which define the thermal capacity of the boiler are determined by the following conditions: *the utilized fuel is : wood pellets with diameter d=8 mm , class ENplus-A1 (see the fuel properties table);*
- The content of ash (mineral incombustible matter) in the fuel does not change significantly the net calorific value, but requires special design of the boiler's burner, in order to achieve reliable and efficient combustion process. That's why the applicability and the effective utilization of certain fuel should be verified and after approval should be utilized in the boiler;
- The producer reserves the right to change the values of the operating parameters, which are controlling the boiler, without prior notice;
- In Table 5.1. are described the factory default values of the thermal capacity stages of the boiler, used to obtain optimal operating conditions;

- The tabled stages for the thermal capacity of the boiler define its thermal capacity;
- The initial adjustment of the boiler is realized by authorized trained service technician, after that no additional adjustment by the end user is required;
- The following text describes the procedure for determining the fuel supply rate and determining the thermal capacity of the boiler:
  - Power on the boiler;
  - Empty the burner's grate from any fuel particles. Empty and clean the ash container and put it back into its position;
  - Performed by authorized technician only, select the „Advance menu" and activate the operating parameter „Stoker adj". **NOTE:** *the access to this advanced menu is restricted by password and is accessible by authorized technician only*;
  - Then the boiler's transport auger will operate continuously for a predefined period of 6 minutes. The collected on the burner's grate and eventually in the ahs container fuel quantity should be weighted and introduced in the operating parameter of the control module, following the onscreen information. After the initial fuel flow rate measurement, the nominal operation of the boiler should be activated. In case the net calorific value of the utilized fuel is known, then it could be introduced in the operating parameters of the control module as well. The factory default value for the net calorific value of the wood pellets is 4,8 kWh/kg. After the fuel specification data has been introduced, these data changes should be saved, by appropriate choice of menu item, indicated on the control module's display – follow the onscreen instructions to proceed, utilizing the appropriate buttons indicated below the text. After these adjustments, the boiler's operating parameter are defined and controlled thermal capacity, complying the appliance producer specifications are achieved;

The producer reserves the right to make changes if the factory default values of the operating parameters without prior notice end users or service technicians.

5.2.7. Adjustment of the boiler, according to the heat consumption rate

It is highly recommended to adjust the operating thermal capacity of the hot water boiler of series "Pelletherm v2" in order to achieve high efficiency and reliable operation of the unit. The adjustment process consists of individual adjustment of the operating thermal capacity stage of the boiler, as shown on Table 5.1.;

At the thermal capacity operating stage adjustment of the boiler the adjustment of the air flow rate, supplied by the air fan, is not required, as the operating mode of the fan is controlled by the boiler's control module unit.

5.2.8. Nominal operating mode of the boiler

After the process of initial operation of the boiler (the fuel on the burner's grate has been successfully ignited) and the boiler's heat exchanger has been tempered and reached steady-state operating mode, it could be assumed that the heating unit is in operating mode, appropriate for precise process adjustment. At steady-state operation the precise adjustments of the boiler should be done and/or the boiler's operation should be checked and verified. The thermal capacity stage of the boiler should be adjusted, complying with heat consumption rate of heating system. At nominal thermal capacity mode is performed the so called "hot test" of the entire heating system, following the local legislation requirements and norms.

ATTENTION : *The air flow rate is substantial for the optimal operation of the boiler as well as the entire local heating system. The air flow rate also influences the efficiency and the reliability of the system – in case the air flow rate is below an optimal operating value (i.e. air deficiency) the fuel is not combusted efficiently and this results in decreased boiler's efficiency. In case the air flow rate exceeds the optimal operating range, this causes combustion chamber cooling and overall boiler's decreased efficiency as well, The above shows, that free access of the ambient air to the boiler should be designed, also for air ventilation of the boiler's room. This will allow efficient operation of the boiler and optimal operation of the entire heating system, resulting in low fuel consumption rate and low pollutant emissions, as well as increased overall reliability of the system's components.*

NOTES:

- During the nominal thermal load of the boiler regular cleaning process is activated and the ash residue remained on the grate of the burner is removed away and is deposited in the ash container, positioned on the bottom of the combustion chamber. It should be noted that before the ash removal process, the fuel delivery to the burner is paused, while the fans are working, thus ensuring conditions for utilization of the char, remained on the grate of the burner. A decrease of the thermal capacity of the boiler could be noticed however;
- If a circulating pump is installed in order to transport the heat energy of the boiler to the consumers, it is recommended to control the inflow temperature to the boiler to be above 60^{o}C. In case of low inflow

temperature level, condensation of water vapor could be observed on the internal heat exchanging surfaces (please consider that water vapor is one of the final products of the combustion process and always persist in the flue gases of the boiler);

- It is not recommended to operate the hot water boiler at thermal capacity lower than the minimal thermal load, as such regimes are not optimal and thus have low efficiency of the unit;
- In case that continuous operation in low thermal load regimes are required, then it is recommended to connect heat accumulator to the heating system, which will ensure high efficiency, economical and reliable operation of the boiler itself, and the entire heating system in general;
- During the very first time of operation the boiler it is possible to observe water vapor condensation on the heat exchanging surfaces of the unit. Practically this is one-time process and will not affect the performance of the unit, neither any problems will arise as well;

ATTENTION : *The air flow rate is crucial for optimal operation of the combustion process, organized in the burner and the boiler overall operation effectiveness – when the air flow rate is less than the optimal one, then this insufficiency will result in incomplete combustion of the fuel, as the supplied oxygen is less than required. When the air flow rate is higher than optimal the result will be unsatisfying as well, because the excessive air will lead to low temperatures in volume for controlled combustion and will result in incomplete combustion of the fuel's volatile gases, released by the combustion process.*

5.2.8.1. Operating mode of the hot water boiler of series "Pelletherm v2 M01"

After the fuel ignition process has been done successfully, the control module of the boiler continues its operation, following factory preset algorithm, in order to stabilize the combustion process, as indicated on the display, show on the figure below:

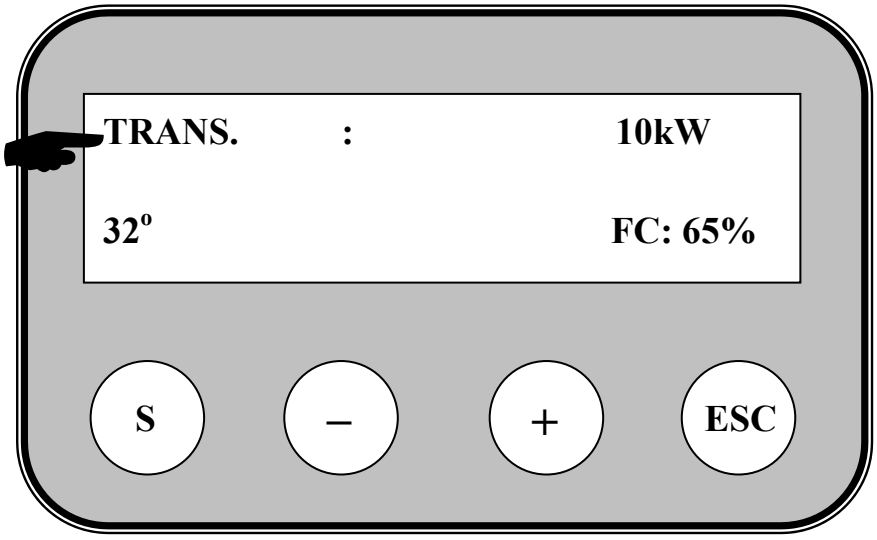

Figure 5.6. The control module display indicates the operating mode of the boiler – "**transition mode"** – transition process from fuel ignition to stabilized combustion process at low thermal capacity stage.

NOTE - „TRANS.:10kW „ – indicates, that the boiler is in intermediate operating mode, operating at thermal capacity of 10kW;

After the transition mode, the boiler's algorithm continues to operate in the defined operating mode, as shown on the figure below:

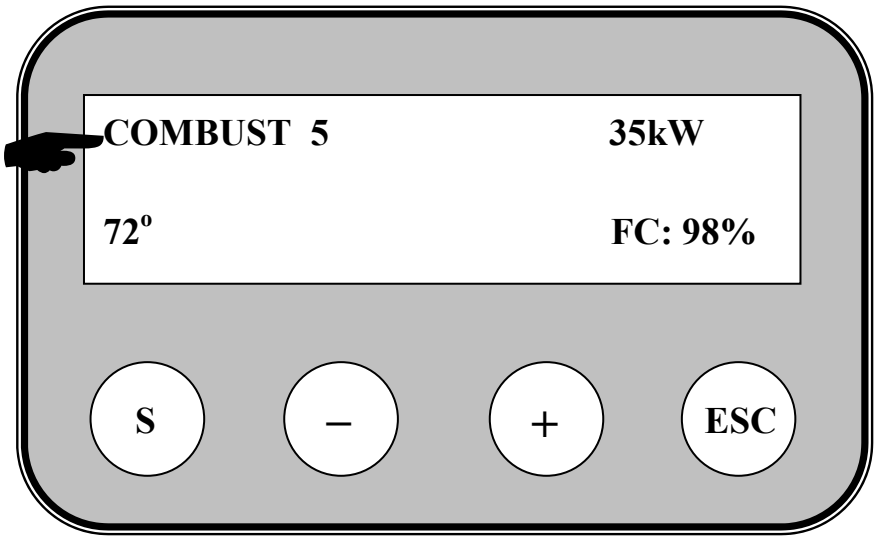

Figure 5.7. The control module's display indicates information for the current operating thermal capacity stage at maximal thermal capacity.

NOTES :

- **„COMBUST 5 – 35kW "** – indicates the operating thermal capacity stage of the boiler (in the example the boiler operates at 5th thermal capacity stage, its thermal capacity is 35 kW);
- **„72^{o} "**- indicates the temperature of the circulating water , [^{o}C];

- **"FC: 98%" –** indicates the intensity of the flame, measured by the photosensor, [%];

5.2.8.2. User menu items of the control module of hot water boiler of series "Pelletherm v2 M01"

At pressing and holding the „S" button the control module enters in user defined menu items and their operating parameter adjustment. Exit the current menu item by pressing the „Esc" button.

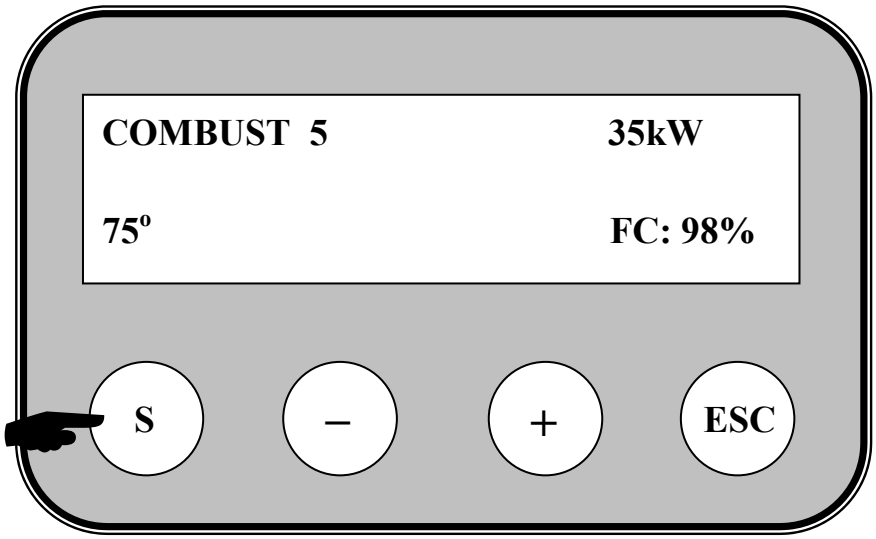

Figure 5.8. Pressing the "S" button allows to choose menu item of the boiler's control module.

5.2.9. User menu items in control module of the hot water boiler of series "Pelletherm v2 M01"

5.2.9.1. Menu item „EFFECT LEVEL"

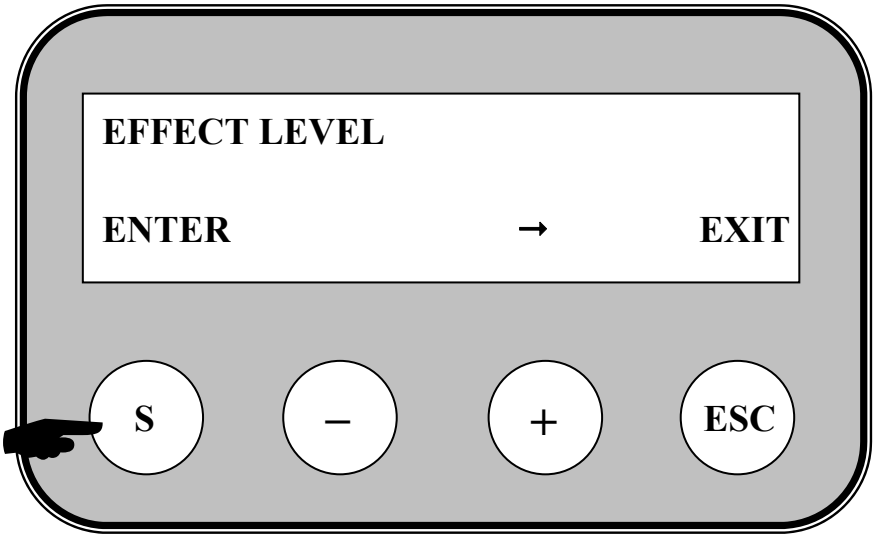

Figure 5.9. Menu item „EFFECT LEVEL" – choice of the operating thermal capacity stage of the boiler.

In this menu item the operating thermal capacity stage of the boiler is chosen and it will operate at this stage until the circulating water set-point is reached, followed by thermal capacity modulation.

In the following table are presented the factory defined thermal capacity stages and their corresponding thermal capacity of the hot water boiler of series "Pelletherm v2 M01".

Thermal capacity of the hot water boiler , [kW]	
Thermal capacity stage	**-**
1	10.0
2	20.0
3	25.0
4	32.0
5	35.0

Table 5.1. Operating thermal capacity of the hot water boiler of series „Pelletherm v2 M01";

NOTE : *It is highly recommended to exploit the hot water boiler of series "Pelletherm v2 M01" at thermal capacity stage not exceeding the 4th including, the 5th thermal capacity stage is designed to operate only in high heat consumption rates for short periods of time*;

In order to chose the menu item „EFFECT LEVEL" one should press the button, below ENTER – button „S". In order to go into another menu item, one should press the "+" button, found below the displayed arrow. Use the button „ESC „ in order to return to upper menu level and going back to the main menu item.

At entering the menu item „EFFECT LEVEL" the end user could choose one of the five operating thermal capacity stages available at set as thermal capacity set-point of the hot water boiler of series "Pelletherm v2 M01".

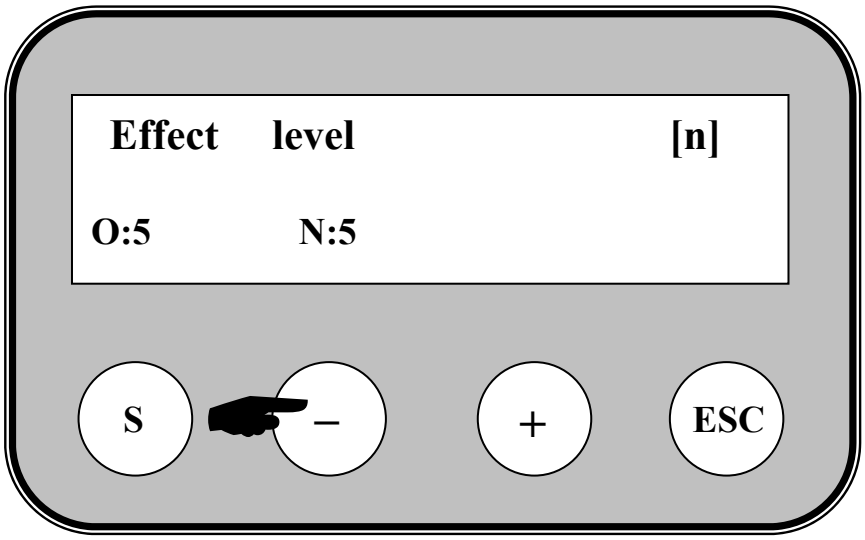

Figure 5.10. Choosing the operating thermal capacity stage of the hot water boiler of series "Pelletherm v2 M01" control module.

NOTE : use the buttons „ + " and „ – **"** in order to ce choose the desired operating thermal capacity stage of the pellet burner. Press the button „S" in order to confirm the choice, in order to exit from the operating menu item press the " ESC " button.

5.3. Adjustment of the thermal capacity of the boiler

The adjustment of the thermal capacity of the boiler is made by choosing the operating thermal capacity stage, which actually defines boiler's thermal capacity.

Information for the thermal capacity of the boiler at different stages of the thermal capacities is given in Table 5.1.

ATTENTION: *In case the fuel has been changed (for example the class of the pellets is changed) this could cause additional adjustment of the boiler's operating parameters.*

5.3.1. Decreasing the thermal capacity of the hot water boiler

The thermal capacity of the boiler is decreased by decreasing the thermal capacity operating set-stage, which results in reduced thermal capacity of the boiler as well as lowered fuel consumption rate;

5.3.2. Increasing the thermal capacity of the hot water boiler

The thermal capacity of the boiler is increased by increasing the thermal capacity operating set-stage, which results in increased thermal capacity of the boiler as well as increased fuel consumption rate;

NOTES:

- At any change of the thermal capacity set-point of the boiler, its operating algorithm automatically makes changes of the operating values for the air flow rate, supplied by the air fan, as well as the fuel flow rate, which allows optimal operation in wide thermal capacity range of the boiler;
- The default values of the operating parameters of the hot water boiler of series "Pelletherm v2 M01" are derived at the following conditions - *the fuel is wood pellets, with diameter d=8 mm, ENplus –**A1** (see table of wood pellets ENplus classification);*
- The ash content (mineral, incombustible content in the fuel) does not influence significantly the gross calorific value of the fuel, but requires specialized design of the burner in order to achieve optimal and efficient combustion process. Following this, one should test the applicability of a fuel for combustion process in the current design of the burner and if positive result is achieved to be massively utilized as fuel material. However, many aspects of the unit operation should be considered;
- The producer preserves its right to change any factory preset value of the operating parameters of the boiler, without a prior notice;

5.4. Stopping the operating mode of the hot water boiler of series "Pelletherm v2 M01"

The stopping process of the hot water boiler could be done by setting off the boiler's "START" switch and/or the remote room thermostat, if installed. The restoration of the nominal operation of the boiler is performed by changing the signal status into on position of the boiler's "START" switch or activating the room thermostat, if attached. In case the operation of the boiler is not required for a relatively longer period of time, then it is highly advisable to clean thoroughly the boiler's combustion chamber, as well as the burner's grate, then power off the hot water boiler of series "Pelletherm v2 M01".

5.4.1. Stopping the operating mode of the hot water boiler of series "Pelletherm v2 M01" by switching OFF the "START" switch

Use the boiler's "START" switch to switch ON and run the operation of the boiler and respectively to switch the unit OFF and stop its process. At switching OFF the boiler's operation, its control module's display indicates "**FINAL COMBUSTION**".

ATTENTION: *at switching OFF the boiler, use the "START" switch, DO NOT switch off the unit by its "POWER" switch*. The reason for the requirement is

that the “START” switch activates controlled switching off procedure of the boiler’s control module, which also cools down the unit and results in total combustion of the char residues, thus preserving its burner’s reliability and efficiency**.**

5.4.2. Stopping the operating mode of the hot water boiler of series “Pelletherm v2 M01” by setting the menu item of its control module.

In order to stop the operation process of the boiler, it is necessary to perform the following procedure:

- Press and hold the “ESC” button (for more than 5 seconds);
- Choose “YES” at the question „Make final combustion?“, indicated on the control module’s display;

If the choice is “YES”, then the display indicates „Final combustion” and the control module performs process stopping of the boiler.

There is another way to stop the boiler’s operation, described below:

In order to stop the operation of an operating hot water boiler, it is necessary to enter the menu item „**MAKE FINAL COMB.”** of the boiler’s control module.

NOTE : *use the above describe option for stopping the operation of the hot water boiler in order to follow the implemented control algorithm and to perform the final combustion of the fuel residue and oxidizing char, found on its burner’s grate*.

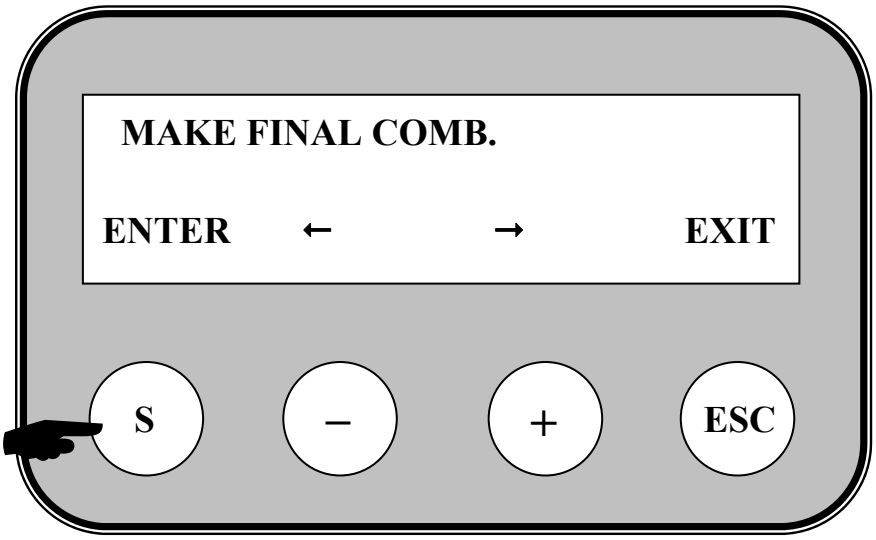

Figure 5.11. Choose the menu item „MAKE FINAL COMB.”, which is used to stop the operating mode of the hot water boiler of series “Pelletherm v2 M01”.

NOTE : in order to enter the menu item „MAKE FINAL COMB." One should press the button "S", in case of rejection, press the "ESC" button, use the " + " and " – " in order to navigate to other menu items

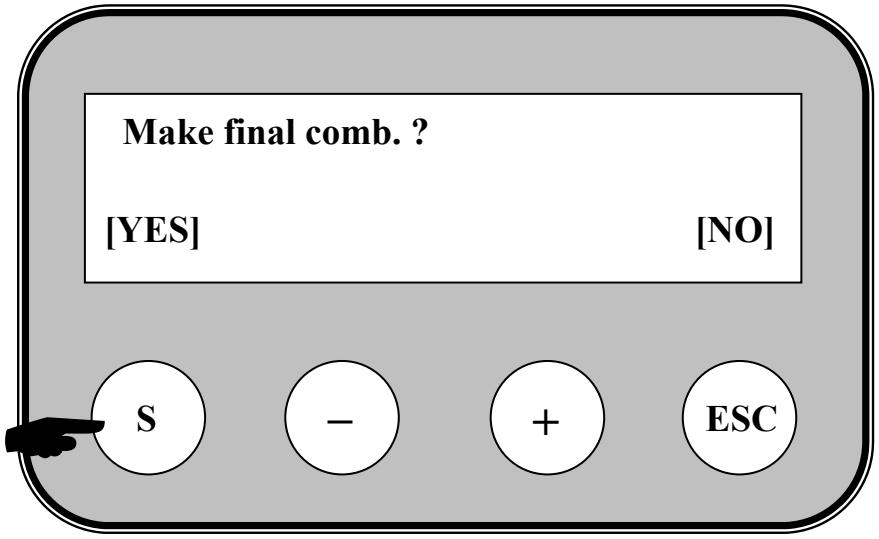

Figure 5.12. The control module's display indicates operating question for choosing the options for activating the stopping process of the hot water boiler of series "Pelletherm v2 M01".

In order to activate the final combustion process, one should press the „S" button, found below the "[YES]" label, indicated on the control module's display. In case of rejection, then one should press the "ESC" button, found below the "[NO]" label, found below.

In case that the boiler will not operate for a relatively long period of time, it is recommended to shut it down by the "POWER" switch and clean the ash deposited in the combustion chamber, beneath it, as well as other surfaces of the combustion chamber.

ATTENTION:

- *In case the boiler will not operate for a long period of time, then thorough ash deposit cleaning procedure should be performed. The ash layer acts corrosively on the unit carbon steel surfaces, which will lead to a decrease of the lifetime of the boiler's main module. It is obligatory to perform service procedures and preventive observations of the unit by trained service personal only as well as thorough cleaning at the end of the heating season. Completing these requirements will ensure long exploitation duration of the boiler and its high efficiency and reliability;*
- *In case there is signal to stop the operation of the boiler, the fuel delivery stops, but the boiler's fans continue to run. That's why at stop signal the boiler continues to operate and the combustion process will continue to*

release heat energy, which makes the system quite inert. This particular feature should be concerned, especially when a local heating system is equipped with radiators with thermostatic control valves (or any other control elements), which stop the flow of the circulating fluid and thus the released in the combustion process heat energy could not be transferred (dissipated) and thus the hot water boiler could be overheated. That's why in case the hot water boiler of series "Pelletherm v2" operates in a local heating system, which have heating elements with thermostatic valves, these valves should not be cutting the heating fluid flow rate, but should allow a minimal flow rate in order to allow heat dissipation in any way. It is recommended to install a heat accumulating tank parallel to the circuits of the heating system in order to achieve a buffer effect and to decrease any variations of the consumption of heat energy by the heating system;

5.5. Turning OFF the hot water boiler of series "Pelletherm v2 M01" by external control module

The boiler is turned off by changing the "START" switch into OFF position. During the boiler's working process in OFF state, the boiler's control module performs so called "controlled turning off procedure" in which the unit fans are working and the boiler is cooled down and operating parameters are simultaneously monitored, in case of emergency appropriate actions will be taken. After the boiler has been cooled down (to ambient temperature), it should be switched off by turning off the unit "POWER" switch. It is recommended to clean the deposited ash thoroughly of the boiler's heat exchanging surfaces.

- **Emergency boiler stop**

In operating process of the boiler emergency situations could arise and the unit will go into alarm/failure mode. Such situations are detected by the process control board and it will go into automatic protective mode in order to be protected. These modes are operated by appropriate preventive measures, automatically taken by the boiler's control board and the alarm mode is indicated by appropriate message, shown on the control module's display. Detailed description of the error codes could be found in Table 5.3. Please check the error messages and refer this manual before taking any actions. After the cause of the alarm situation is clarified, take adequate actions for bringing back the boiler into normal operating conditions and restart it by switching off its "POWER" switch and back into ON. Prior to powering ON the boiler, clean the ash and char residue, accumulated on the burner's grate in order to allow reliable ignition and operation of the unit.

ATTENTION: *in case of emergency situation – boiler overheating, its emergency thermostat is activated. In this case the boiler should be cooled down and the reason for such emergency situation should be investigated and preventive measures should be performed. The emergency thermostat should be manually reset by unscrewing its preventive cap and its stem should be pressed until the thermostat switches back on (a "click" sound is heard in this process), then screw back its cap. After the boiler is checked and the cause for overheating is determined and repaired, restart the unit by turning off its power supply and then back on in order to run it in normal operating mode*;

5.6. Menu item, indicating list of the latest 10 errors, arose from the operation of the hot water boiler of series „Pelletherm v2 M01"

In order to check the last logged errors got at the operation of the hot water boiler; one should enter the "LOG" menu item.

NOTE : *in the "LOG" menu item are shown only the latest ten (10) errors logged, as result of the operation of the boiler. In case of abnormal operation of the boiler arise, the logged error codes are stored in FIFO (first-in-first-out) mode and the error, which exceed the capacity of the log list will be replaces with the next error log message, thus the newest error code will be stored successfully*;

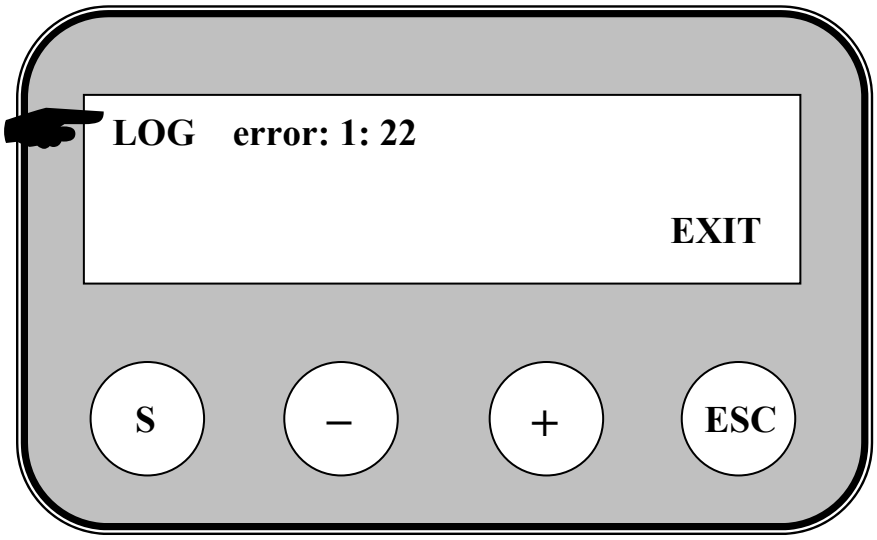

Figure 5.13. The boiler's control module display indicates the chosen "LOG" menu item, also the number of the error in the log list and its code number.

In order to exit the operating menu item, press the "ESC" button.

In **Table 5.3** one could find information for the error code number and detailed description in order to resolve a problem.

5.7. Restarting the operation of a hot water boiler of series "Pelletherm v2 M01"

The restarting of the boiler is required in case of failure modes, for example the boiler has a start signal, but its control module is operating in safe mode, which is not allowing nominal operation of the unit. The boiler control module's display indicates the error code number. It is necessary to take precaution measures in order to solve the problem and to remove the cause for the failure. After that the boiler should be restarted – this is performed by switching off and back on the "POWER" switch. It is recommended to check and eventually clean the grate of the burner before starting the unit again.

5.8. Showing and teaching the end user about the maintenance and adjustment procedures.

It is necessary to show and teach the end user the maintenance procedures for operating the boiler efficiently and keep its reliability in high degree order. Also the installer should demonstrate and teach the end user how to change the operative parameters of the control module of the boiler in order to operate the unit in different modes and heat capacities, according to the local heat consumption:

- **Fuel hopper charging** – the fuel is poured out in the hopper of the boiler and the hopper's cap should be closed in order to prevent uncontrolled air penetration to the burner through this section;
- **Ash cleaning procedure** – it is recommended to clean periodically the ash residue (at least once per day) the convective heat exchanger part of the unit by manually swinging the cleaning lever for semiautomatic ash cleaning process. Covering this requirement will ensure effective heat exchanging process and will sustain optimal operating conditions of the boiler. Detailed ash cleaning and maintenance procedures are described in **ANNEX 1** of this manual;

ATTENTION : *regular cleaning of the ash residue, deposited on the heat exchanging surfaces of the boiler will ensure long-life reliable exploitation period, economic and efficient performance of the unit;*

5.9. Safety and unexpected risks

Risks could arise at the exploitation of the boiler:

The hot water pellet boiler of series "Pelletherm v2" is designed according to the safety requirements of the operating European standards and norms. However safety and unexpected risks could arise in situations like following:

- *Hot water pellet boiler of series "Pelletherm v2" is operating incorrectly;*
- *The unit is installed by unauthorized/unqualified personal;*
- *The safety instructions, described in this manual are not followed and fulfilled;*

Unexpected risks:

The unit is designed and produced according to the requirements of the operating EU safety norms. However, in spite of that possible risks are considered as a result of the operating process of the boiler, it is possible to get risks as follows:

- ***Cauterization risks**, caused by high temperatures, as a result of the combustion process in the combustion chamber and/or direct access to the front door of the combustion chamber, at manual cleaning processes of the surfaces of the burner and/or combustion chamber, or ash residue cleaning, accumulated in the ash tray or any unburned fuel material, smoldering in the ash tray;*

- ***Electrical shock risks** at indirect contact. The boiler is connected to the power circuit and its operating modules are separated in specialized electric control box, equipped with required protective and short-circuit preventive devices. It is obligatory to perform boiler ground connection by authorized personal/technician.*

- ***Fingers injuring risks** at opening/closing the doors/caps of the boiler at maintenance and cleaning process of the unit. It is recommended to use appropriate individual resources for self-protection;*

- ***Suffocation risks** due to flue gas uncontrolled emissions in the boiler's room, in case when the chimney draught is insufficient, in case that the convective part of the boiler is clogged, or in case that the flue gas duct is not fully tightened and gas leaks are possible;*

5.10. Operation faults and their repairing

No	Operation fault	Cause	Method for repairing
1.	Low temperatures in the heat supplied rooms	Insufficient heat capacity	Adjustment of boiler's thermal capacity is required
		Low set-point temperature of the boiler's circulating temperature set-point	It is necessary to increase the set-point of the boiler's circulating water temperature (up to 85^{o}C)
		Low set-point temperature of the remote room thermostat (if connected)	It is necessary to increase the set-point of the room thermostat
2.	High temperatures in the heat supplied rooms	High set-point temperature of the boiler's circulating water temperature set-point	It is necessary to decrease the set-point of the boiler's circulating temperature set-point (it is recommended to keep it above 60^{o}C)
		High set-point temperature of the remote room thermostat (if connected)	It is necessary to decrease the set-point of the room thermostat
3.	The boiler is active, but no combustion process	"START" signal is not present	It is necessary to check the status of the operation signal of any of the following : room thermostat or "START" switch
4.	Difficult fuel ignition	Low quality fuel	It is necessary to replace the fuel, most probably due to its high moisture content, which could be above the required value for nominal operation of the boiler
5.	Boiler's emergency overheating	Absence of heat consumption or incorrect adjustment of the boiler's thermal capacity operating stage or poor operation of the heating installation	It is necessary to check the correct operation process of the heating installation and eventually appropriate adjustment of the operating thermal capacity stage of the boiler and/or control valves of the installation – *this should be performed by authorized*

			technician. After the boiler is cooled down to ambient temperature and the reason for boiler overheating is serviced out, the protective cap of the emergency overheating thermostat should be unscrewed, its rod should be pressed until the thermostat is reset and it's cap should be screwed back. The main "POWER" switch is turned OFF and back ON afterwards and the boiler is thus restarted.
6.	No fuel ignition	Absence of fuel in the hopper	The fuel hopper should be charged.
		Absence of fuel in the burner	It is possible to manually restart the operation process of the boiler
		Fuel is present in the burner, but it's not ignited or it is fully incinerated and the combustion process has extinguished, i.e. not present;	In case that the electrical heater is out of order or not operating, then it should be replaced with appropriate working one – *this should be performed by authorized technician*;
		Abnormal operation or malfunctioning of the photosensor	The photosensor should be checked or replaced in case it is out of order
7.	The flame looks "opaque" and smoke is observed at the exit of the chimney	Low quality pellets	Fuel replacement is recommended, most probably the moisture content is higher than required;
		Inappropriate operating parameters adjustment	It is necessary to perform adjustment of the operating parameters of the unit and achieve efficient combustion process - *the adjustment should be performed by authorized technician*;
8.	Presence of unburned fuel in	Ineffective fuel combustion process	It is necessary to clean the ash residue, deposited below the

	the ash tray		burner's grate; It is necessary to perform adjustment of the operating parameters and the air flow rate – *the adjustment should be performed by authorized technician*;
9.	Alarm – absence of ash cleaning	A problem in ash cleaning system	It is necessary to contact the service company and help of a authorized technician is required;
10.	High temperature of the flue gases (if flue gas thermometer is mounted)	The heat exchanging surfaces of the boiler are deposited with ash, presenting heat resistive layer, thus decreasing the heat exchanging intensity	It is necessary to clean thoroughly the heat exchanger surfaces of the boiler;
11.	Water vapor condensates on the surfaces of the combustion chamber	Low temperature of the inlet water flow	It is necessary to perform adjustment of set-point temperature, which controls the circulating pump of the heating system. It is recommended to adjust the set-point temperature to minimum of 65^{o}C;
12.	Flue gases are emitted out in the boiler's room after certain period of exploitation	The flue gas fan is clogged or even blocked by fly ash deposits	It is necessary to clean thoroughly the flue gas fan and its casing
		Incomplete tightness of the combustion chamber's door or/and other flue gas duct	It is necessary to perform adjustment and tightening of the combustion chamber's door, as well as any other lids, eventually change the heat resistant ropes – *this should be performed by authorized technician only*
13.	The fuel transport mechanism is not functioning	The door of the fuel hopper section is opened	The door's safety switch is active – this door should be closed
		The door of the fuel hopper section is closed, but the fuel transport auger is not functioning	The fuel transport mechanism should be checked – *this should be performed by authorized technician only*

14.	Other failures, not described above		It is necessary to consult authorized technician and eventually service maintenance should be performed

Table 5.2. Description of operation faults of the hot water boiler of series "Pelletherm v2", causes and methods for repairing.

No	Error code	Description of the error	Method of repairing
1.	10	Unsuccessful fuel ignition	Clean the burner's grate; Check for fuel available in the hopper and the auger charged; *Ask for help an authorized technician;*
2.	11	Flame process loosed at operation of the boiler	*Ask for help an authorized technician;*
3.	12	Error at operation of the photosensor	*Ask for help an authorized technician;*
4.	13	The control board ambient temperature is above defined limit	Switch off the boiler and let the unit to get cooled; *Ask for help an authorized technician;*
5.	14	The circulating water temperature sensor has measured temperature levels below 5^{o}C	The circulating water has low temperature, high danger of freezing and mechanical damages; *Ask for help an authorized technician to check the entire heating system;*
6.	15	The circulating water temperature sensor has measured temperature above 120^{o}C	The circulating water has hazardous high temperature and there is high risk of overheating of the heating system; *Ask for help an authorized technician to check the entire heating system*
7.	16	Control board faulty operation	*Ask for help an authorized technician;*
8.	18	Air control relay failure	*Ask for help an authorized technician;*
9.	19	The air fan does not rotate	*Ask for help an authorized technician;*
10.	20	The air fan does not run at the designed rotation speed	*Ask for help an authorized technician;*
11.	21	The initial fuel ignition has failed	Check the presence of fuel and the proper operation of the auger; *Ask for help an authorized technician;*

12.	22	External auger failure	*Ask for help an authorized technician;*
13.	23	The photosensor does not get dark at the final combustion process	*Ask for help an authorized technician;*
14.	24	Loss of light of the photosensor at normal operation of the boiler and unsuccessful fuel ignition after the initial ignition process	*Ask for help an authorized technician;*

Table 5.3. Description of the error codes, stored in the „LOG" list of the menu item of the control module of the hot water boiler of series "Pelletherm v2 M01".

No	Text, shown on the control module's display	Description	Method of repairing
1.	IGNITION FAILED	Failure at ignition	Check if fuel is available and check the auger's operation; In case there is fuel – *ask for help an authorized technician*
2.	LOST FIRE IN COMBUSTION	Flame loss at normal boiler's operation	Restart the boiler Check the connection of the auger power supply – *ask for help an authorized technician*
3.	STOKER FAULT	Auger disconnection	Check the connection of the fuel transport auger;
4.	TEMP- SENSOR LOW	Temperature sensor disconnection	Check the connection of the NTC sensor
5.	PHOTOSENS	Problems at photosensor operation	Check the condition of the photosensor, replace if necessary – *this procedure should be done by authorized technician only*;
6.	TEMP SENSOR OVERHEAT	High temperature, estimated by the photosensor	Check the condition of the hot water boiler, cool down the unit;

Table 5.4. Error description, shown on the hot water boiler of series "Pelletherm v2 M01" control module display.

5.11. Hot water boiler warranty form completion.

The applied WARRANTY FORM should be completed, by filling the required information in the appropriate fields. The assigned field for signatures and stamp should be completed as well in order to VALIDATE the WARRANY FORM of the unit.

5.12. Actions, after the unit is not in exploitation anymore.

After the lifetime period of the unit has been completed, then it should be treated properly in order to preserve environment contamination. The unit should be dismounted and disassembled by environmentally safe methods. This requirement is most commonly completed by appropriate components recycling, considering separate waste disposal and utilization methods.

6. Electrical scheme of automatic pellet boiler of series "Pelletherm v2 M01".

Figure 6.1 show electrical scheme of hot water pellet boiler of series "Pelletherm v2 M01".

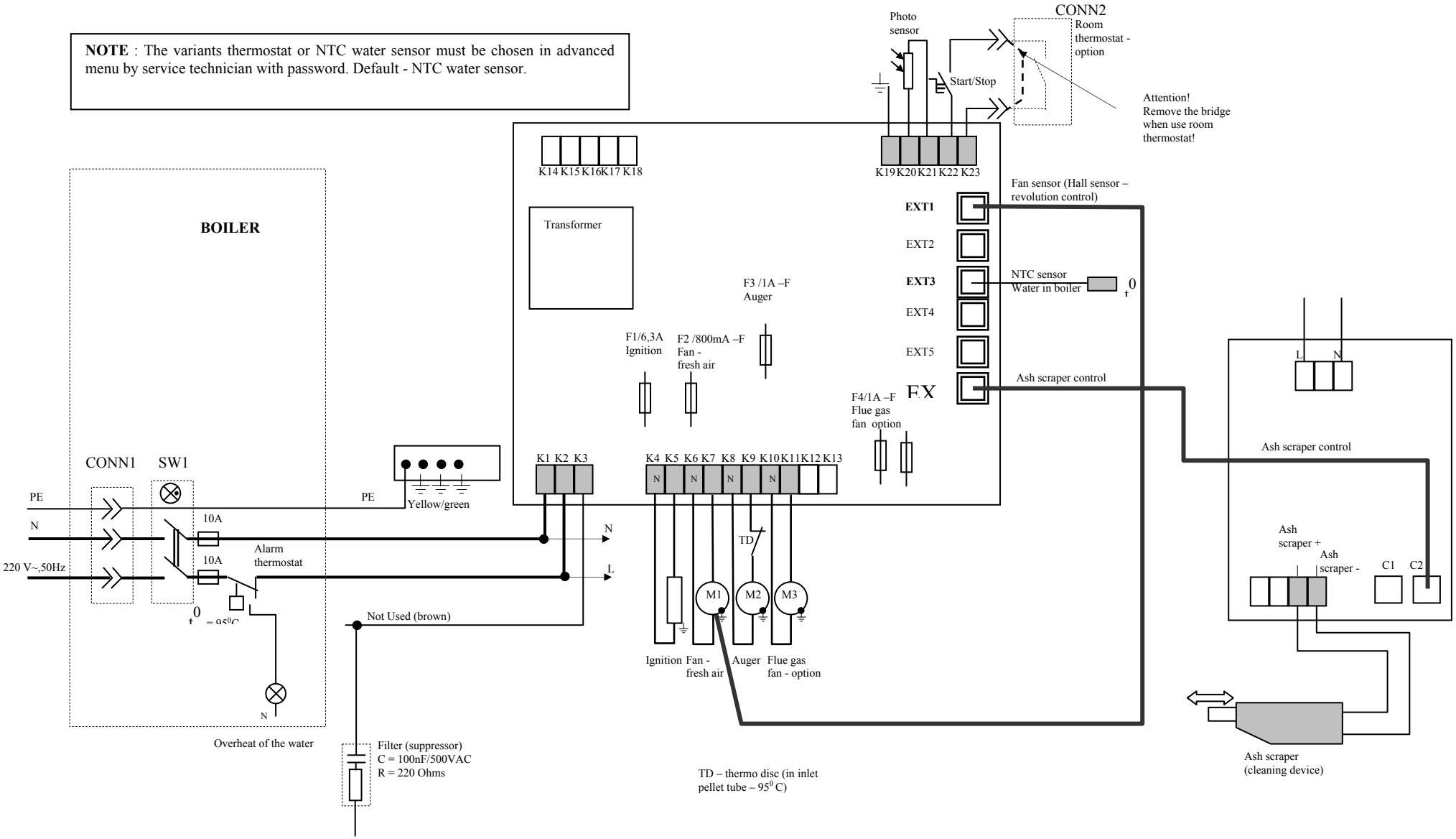

Figure 6.2 Electrical scheme of the control board of hot water pellet boiler of series "Pelletherm v2 M01"

WARRANTY CONDITIONS

The producer guarantees correct and reliable operation of the unit ONLY when installation and maintenance requirements are completed.

The warranty period of the boiler starts from date, when the warranty form is filled and stamped by the authorized organization.

THE WARRANTY OF THE UNIT IS NOT VALID in case one of the following is fulfilled:

- Unit damages, caused by incorrect handling, transport and/or loading/unloading, which are not organized by the producer;
- Failures, caused by natural disasters (Earth quakes, fires, floods, etc.);
- Unsatisfied installation, maintenance and service requirements, which are described in this manual and its annex;
- Repairing of any failure of the unit, performed by unauthorized technicians or the end user;
- Any changes in the design of the boiler;
- Incorrect heating system project (design) and implementation;
- Failures, caused by factors, for which the producer could not be blamed and/or has no control over them;
- Any malfunctions or damages, which are not caused by the operation of the boiler itself, but result in unit damages and its functionality;

Every warranty service operation should be noticed in its warranty service procedures list.

The warranty period of the unit is interrupted by the period, during which the unit is warranty serviced by authorized technicians (the period between failure notification and its repairing).

The warranty period of the unit is **24** months.

The warranty of the unit is valid when the original invoice document and the original warranty form are presented only.

ANNEX 1

Hot water pellet boiler of series “Pelletherm v2”

end-user maintenance procedures

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ANNEX 1 Hot water pellet boiler of series “Pelletherm v2” end-user maintenance procedures

(Document edition : 12.05.2012 12:29*)*

1. General principals

The fuel of the hot water pellet boiler of series “Pelletherm v2” is wood pellets (or any other, verified and described in the user manual of the boiler) and the residual of the combustion process is mineral ash. The quantity of the ash depends on the fuel mineral mass content, i.e. fuel’s quality. The practice shows that main part of the ash residue is collected in the ash hopper of the boiler, however ash is deposited on the heat exchanging surfaces as well and other surfaces that are in direct contact with the flue gases (the burner, the flue gas fan, etc).

The ash residue quantity, collected in the main ash hopper (positioned in the combustion chamber) should be cleared periodically, considering the operating mode of the boiler as well as the fuel quality.

The practice shows that according to the ash in that hopper should be cleaned (thrown away) periodically – between one and five days (the fuel should cover the requirements, depicted in the user manual of the boiler).

It is advisable to clean the convective part of the heat exchanger – by utilizing the applied the specialized lever – it should be plugged in the profiled orifice and swing the lever in both direction several times (which actually will activate the semi-mechanized cleaning system of the boiler).

The total ash cleaning procedure should be performed once per month – advisably, but not more that two months period of hot water boiler’s operation. The period between ash cleaning of the boiler should be clarified at practice, as it depends mainly on the fuel quality.

2. Hot water boiler ash cleaning procedure

ATTENTION – *it is strongly recommended to have self protection – utilize gloves, protection glassed and appropriate clothing, as the risk of injuries is high at high temperatures of the surfaces in the combustion chamber of the unit.*

The following sections will describe the cleaning ash cleaning procedures in details.

Figure 2.1. Working gloves and working apron, provided for easy and safe cleaning process of the ash residue.

2.1.How to stop the operation mode of the hot water boiler

The nominal operation of the boiler should be stopped by switching off its operating mode – refer to the boiler's user manual for more details. After the boiler has been stopped, it takes time until the fuel, which is burning in the burner will be entirely combusted and the heat exchanger is cooled down to safe levels of the temperature;

2.2.Switch off the boiler

Utilize the boiler's "POWER" switch to turn off the power supply of the unit. For more details please refer to the boiler's user manual;

2.3. Cooling down the boiler

After the boiler is switched off it should be cooled down – it is necessary to wait until the temperature of the circulating water is moderate and the heat exchanging surfaces are cooled down to safe levels and the ash cleaning procedure could start.

2.4. Cleaning the ash of the heat exchanger surfaces

Before the ash cleaning it is necessary to open the top cover of the heat exchanger body.

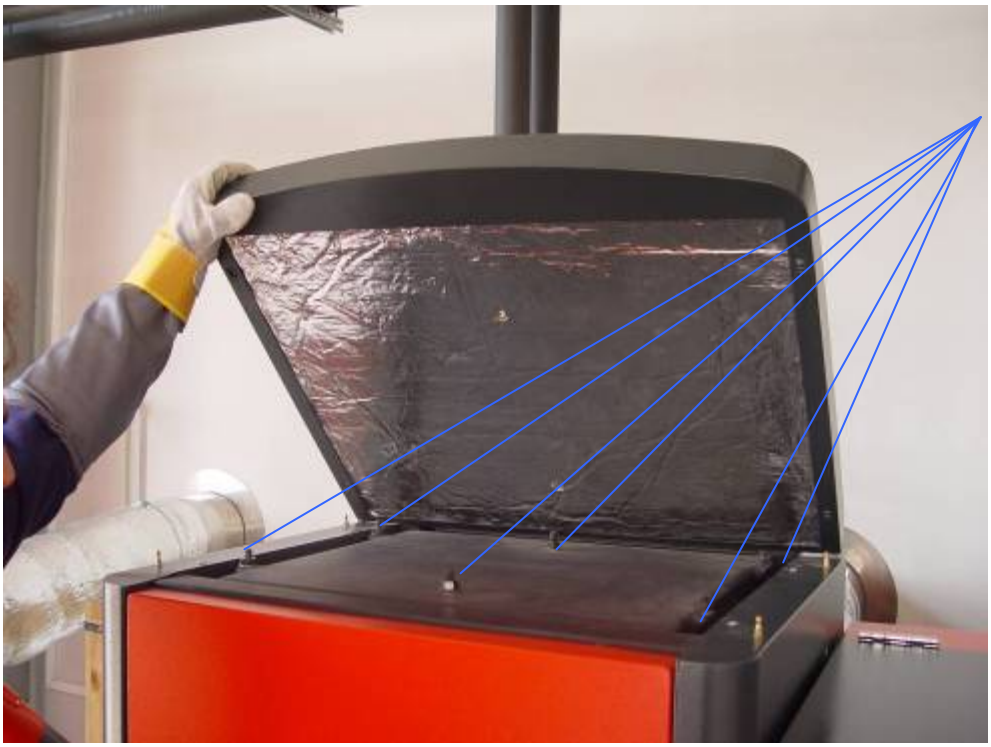

Figure 2.2. The top cover of the heat exchanger is lifted up.

The fixing nuts should be unscrewed and flue gases duct lid should be removed.

Figure 2.3. The flue gases duct lid is detached (*the ash residue is clearly seen on the boiler's heat exchanger surfaces*);

Utilize appropriate tool to clean (to grate) the ash and char deposition off the internal surfaces of the boiler's body.

ATTENTION : *the practice shows that the ash grating is connected with intensive release of fly ash, thus it is highly recommended to wear air breathing protective mask as well as appropriate clothing in order to minimize any lung issues and cloth staining;*

Figure 2.4. Ash deposits cleaning;

Figure 2.5. Brushing the ash layer of the heat exchanger surfaces;

The next step of the cleaning procedure is to clean the ash deposits on the third part of the flue gases duct of the boiler.

Figure 2.6. Cleaning the ash deposits off the heat exchanger surfaces, as well as off the ash cleaning mechanism;

The ash should be thoroughly cleaned off the metal parts (from the cleaning mechanism and the heat exchanger as well).

EXPLANATION : *the ash particles, laid on the horizontal surface of the heat exchanger (at the flue gas pipes side) could be cleared by a specialized vacuum cleaner or it could be swept down through the pipes to the surfaces underneath – the ash will be cleaned from the surfaces underneath. Detailed description will be shows in the next sections*;

The next step of the cleaning procedure is to clean the internal surfaces of the pipes of the heat exchanger – this is done by manual movement of the pipe's ash cleaning mechanism;

Figure 2.7. Attachment of the heat exchanger pipes ash cleaning actuating lever;

The next step is to detach the front face panel of the heat exchanger in order to get access to the lid of the second ash deposition zone of the boiler – the area right above the burner and below the pipes.

Figure 2.8. Detaching the front panel of the heat exchanger;

The next step is to unscrew the fixing nuts of the lid, which closes the secondary ash deposition zone of the three way flue gas duct of the heat exchanger. Notice that the lid is tightened in order to prevent any flue gases leakage or ambient air both in and out of the flue gas duct.

Figure 2.9. The lid of the secondary ash deposition zone is detached and the ash layer should be cleaned away;

Figure 2.10. Cleaning of the ash in the secondary deposition zone of the heat exchanger (right beneath the pipes of the heat exchanger);

EXPLANATION : *it is recommended to position the ash hopper in a position, which will allow easy collecting of the ash residue*;

The next step is to clean the ash and char residue, deposited in the burner.

ATTENTION: before lifting up the cover of the burner, it is necessary to make a safety check, i.e. to verify that the temperature of the burner's details is low enough to handle and continue with the manipulations. It is strongly recommended to get measures for self protection.

Figure 2.11. Lift of the burner's arc lid;

EXPLANATION : *the lid of the burner is freely mounted and no fixing items are used. It is positioned by special locking pins, fixed to the lower part of the burner in its front side*.

Figure 2.12. Ash and char cleaning procedure of the material, laid on the burner's grate;

Figure 2.13. Brushing and cleaning the ash residue and any other char remaining particles on the burner's grate;

After the burner's grate has been thoroughly cleaned, it is necessary to clean the ash beneath the grate.

EXPLANATION: *the burner's grate is detached by lifting and alongside pulling action. It is possible to have difficulties when detaching the grate due to the deposited ash and eventually any thermal deformation of the details. It is necessary to take care at the grate removal procedure and to keep the ash grating element not damaged (it is not necessary to apply excessive force in order to remove away the grate).*

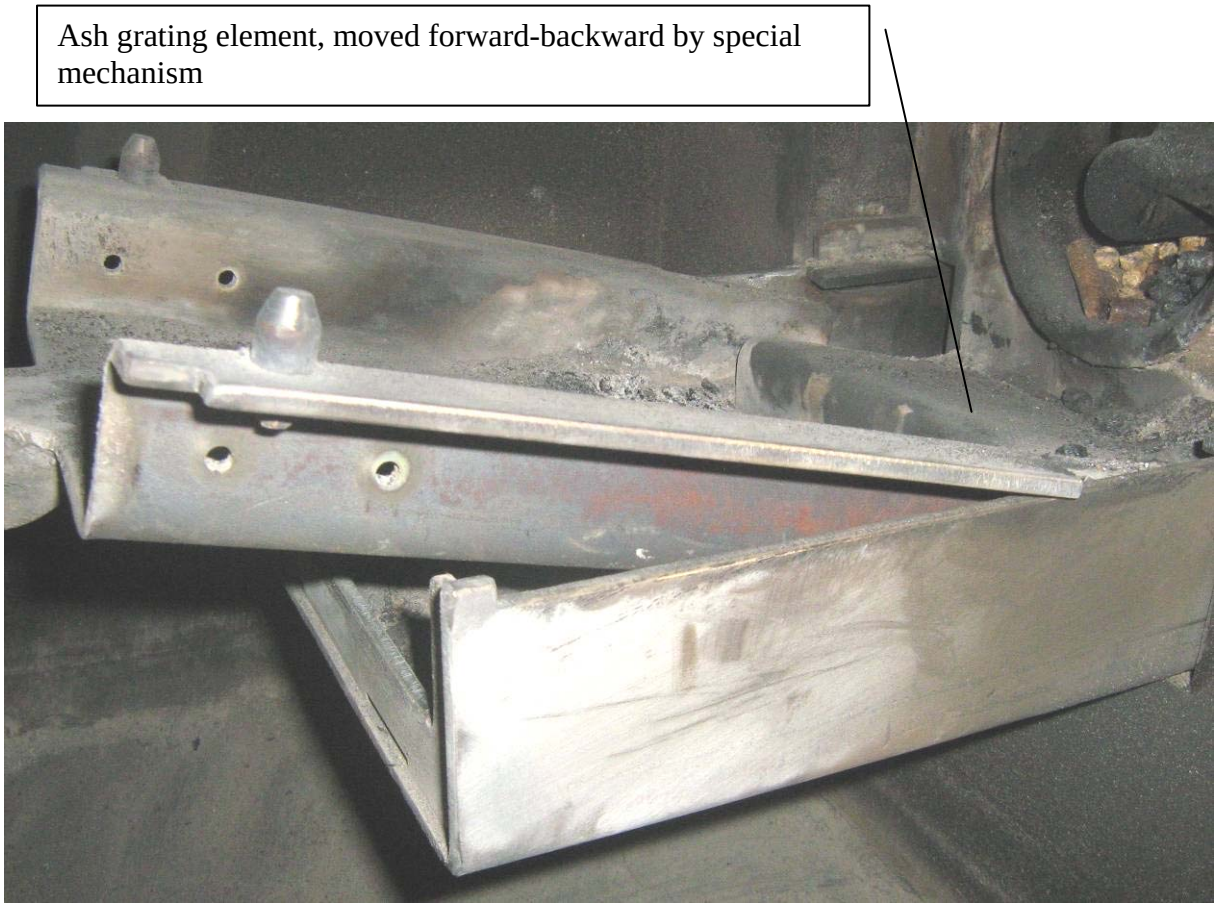

Figure 2.14. Detaching the grate of the specialized burner;

Figure 2.15. Cleaning the ash residue, fallen beneath the grate of the burner;

The next steps are to take away the ash hopper, placed on the bottom of the combustion chamber, to deposit away the ash residue in special fire protected container. The cooled down ash could be utilized as soil fertilizer.

Figure 2.16. Tacking the ash hopper out of the combustion chamber;

2.5. Attachment and assembly of the elements, detached at the ash cleaning procedure

The attachment procedure should be done in reverse sequence of the steps, depicted in the previous sections of the manual.

ATTENTION: it is necessary to ensure air-tightness if the lids of the flue gases duct of the boiler (these are the lid of the ash deposition secondary zone, as well as the top lid, covering the flue gases duct of the heat exchanger), in order to ensure high reliability and efficiency of the appliance.

3. Recommendations and requirements

It is highly recommended to perform the above described procedure of ash deposition cleaning as it will ensure high efficiency and reliability of the boiler. It is recommended to ash clean the unit on a period of a month of operation, but it is necessary to clean the ash on operation period of no more than two months, considering the operating mode of the boiler as well as the ash content of the raw fuel;

ATTENTION:

- After each cleaning procedure, the boiler should be checked out – the correct attachment of the element, the air-tightness of the lids and the boiler's functionality;
- At the end of the heating season it is necessary to perform thorough ash cleaning of the boiler, because the mineral ash acts as corrosive reagent and reduces the reliability of the boiler. It is recommended to take away of the fuel hopper any pellets (of other fuel if utilized) as the pellets could absorb moisture from the ambient air and cause clogging of the fuel transport auger, issues with the ignition, etc.;

*The above depicted ash cleaning procedure is **OBLIGATORY**. In case that the ash cleaning and boiler's maintenance procedures are not followed, it is possible to decrease the efficiency and performance reliability of the boiler, even operation failure could be achieved (for example clogging of the ash cleaning mechanism, flue gas fan blockage, etc.).*

Instruction for cleaning pellet boiler

Pelletherm

Before cleaning the utility must be turned off and cooled down!

It is obligatory to use safety guards!

Erato Appeals! Read the user manual guides!

Pull the handle up and turn it left-right with several repeats.

Open left front door

Remove and clean the ash-tray.

Remove burner head top cover and perform cleaning.

Clean slag and ash remains.

Remove lower fire-grate and clean air inlet holes. Install fire-grate and cover back.

Remove heat exchanger top cover.

Clean the heat exchanger wall by scrapping them with the tool.

Remove heat exchanger front cover by pulling it forward.

Unscrew both feather-nuts.

Open the lid!

Clean the ash residues.

Install the lid back.

Cleaning set!

Cleaning with the handle has to be performed on every refilling with pellets.

Cleaning the burner's fire-grate has to be performed at least once per week or more often, depending on fuel quality (information by the fuel manufacturer).

Cleaning the heat exchanger walls has to be performed twice during the heating season or more often depending on fuel quality (information by the fuel manufacturer).

Cleaning burner's head from ash residues has to be performed at least once per month, but no longer than two months.